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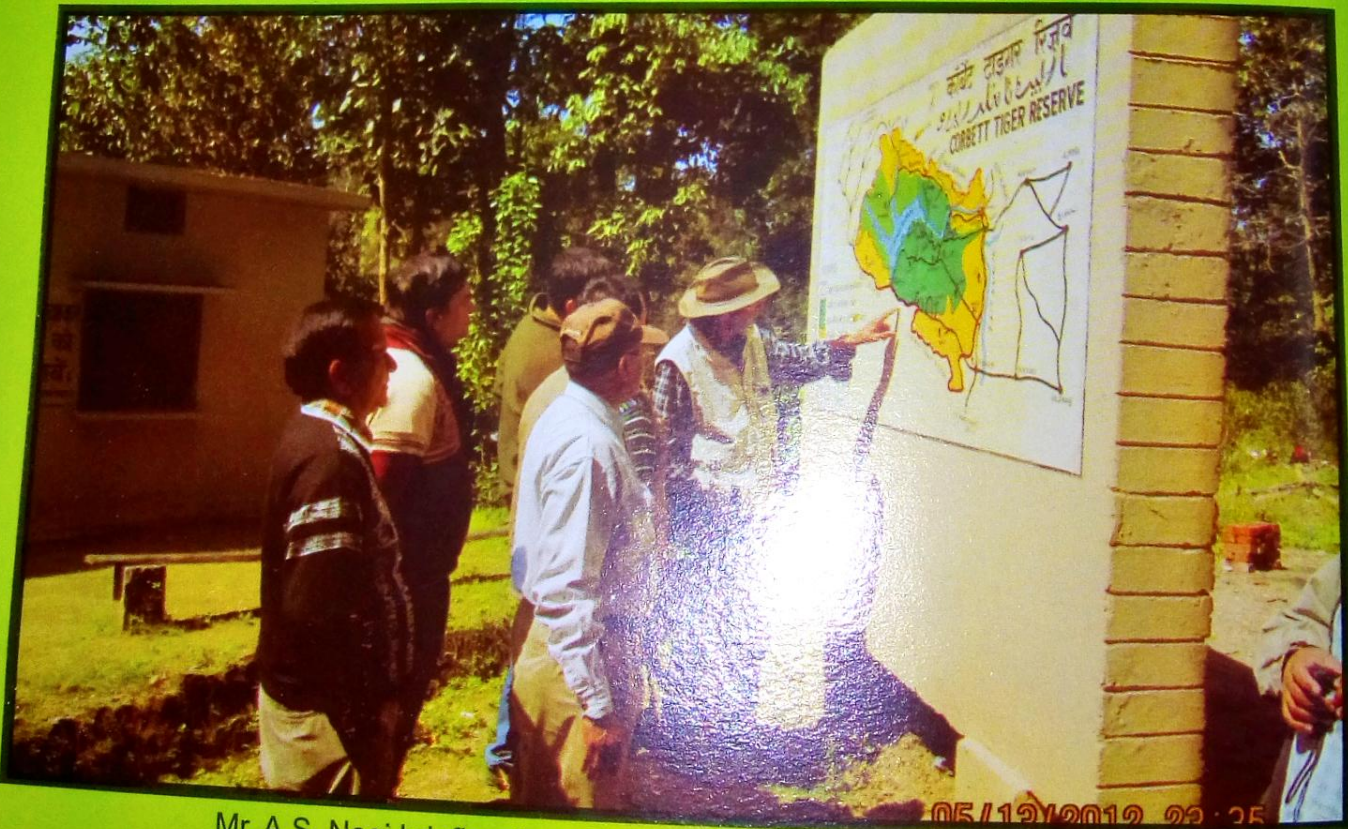
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Photo by Dr. Dushiyant singh Gaur



Excursion Tour by Executive Members to River of Gold - Sona Nadi Corbett Tiger Reserve
 MR. S. Raghav, Rajeev Mehta(Ex-Vice President), Dr. Prashant Singh , A.S. Negi (President),
 Dr. Dushyant Singh Gaur, S.k. Banerjee(Vice President), MR. Dobhal & Md. Mansoor Mazher(not in Picture)



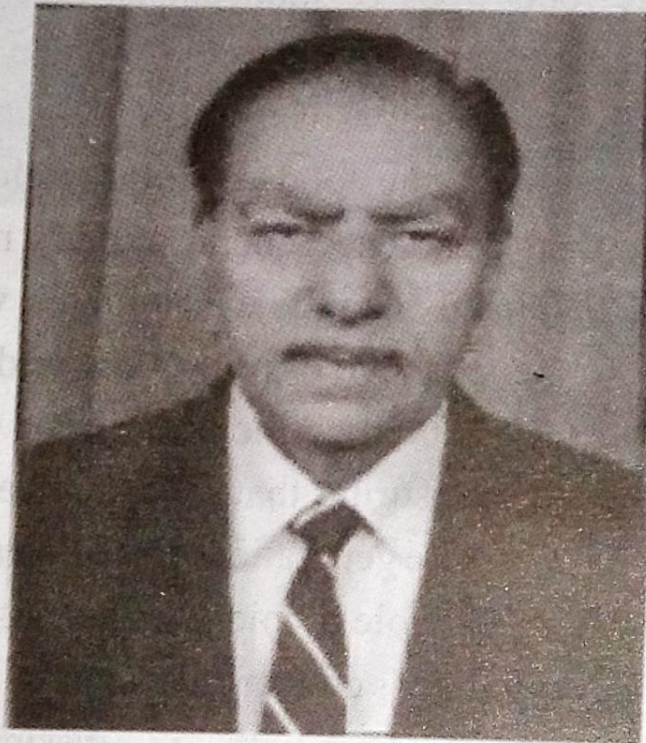
Mr. A.S. Negi briefing the members the location of Tigers Habitat

EDITORIAL

It was quite late that the human race could understand the inherent importance of the food webs & food chains along with the dire necessity to maintain the various food webs. The size and life cycle of any living object is immaterial as it forms an essential link in the component food chains of the food web that yields all important sustenance to the food web. The general public's notion about the word WILD LIFE that it only engulfs wild animals, whereas the wild life Conservation is the practice of protecting wild plants and wild animal species and their habitats. Among the basic objectives of the wild life conservation ;, ensuring that the natural nature habitats will be available to the future generations in its sustained condition.. Bio-diversity conservation, role of microbes and insects is one set of components that need society's concern. Awareness campaigns in any form are welcome and the best path is dissipating awareness through the school going youth of today , who will become responsible educated citizens of our human society. The WPSI is organizing a Painting competition and a Declamation contest, during the Wild Life Week 2014, in the honour of Maharaja Nabha, the main inspiring force behind the establishment of the Wild Life Preservation Society of India [WPSI]. It is expected that the future citizens of the world will understand the importance and necessity of the Wild life preservation. We would very much welcome research papers or articles also on plant kingdom members along with the animal kingdom members. Articles in Hindi language will also be appreciated.

A.S. Negi

Obituary



We sadly inform the demise of Shri. R.K. Mehta, the Chief Patron of WPSI at his Chitra House Haridwar on 11th April 2014 after a brief illness. He was 83. He was a retired Himachal Pradesh Cadre IPS Officer with distinguished service record. He had taken part in counter insurgency operation in Punjab with Mr. JF Rebeiro and Mr. KPS Gill and was witness to Indo-Pak Shimla agreement signed by Smt. Indira Gandhi and JA Bhutto. He was a highly decorated officer who had received Presidents Police Medal Twice, Samar Seva Medal, Raksha Medal, Sangram Medal, Kathin Seva Medal, Independence Anniversary Medal, Bar Hard Duty Kathin Seva Medal and Director Generals Commendation Disk apart from several appreciations and commendations from State Government. His son Rajeev Raj Mehta is Executive Vice President of WPSI and an active Wildlife enthusiast. He is survived by his wife, son and 2 daughters (and 6 grand children) all well settled. Till last moment he was busy in supervising his ancestral Chitra Cinema in Haridwar. Mr. Mehta's passing away is a great loss to his large family and friend circle but equally to our Society and we all pray that his soul may rest in peace in heaven and inspire us to conserve our wildlife and environment.

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Sona Nadi Wildlife Sanctuary : A lesser explored haven in Corbett territory

Dr Dushyant Singh Gaur MD

Sona Nadi Wildlife Sanctuary of Corbett territory was the destination planned for excursion by the members of Wildlife Preservation Society of India (WPSI) from 7th to 9th March 2014. Our group comprised of Mr. A. S. Negi (President WPSI), Dr Prashant Singh, Mr. Sudhir Raghav, Mr Rajeev Mehta, Syed Mansoor Mazhar, Mr P.K. Dobhal, Mr S.K. Bannerjee and myself, Dr Dushyant Singh Gaur.

Sona Nadi literally means 'river of gold', a name based on the fact that 'gold-panning' was actually carried out in the river before the area was declared a wildlife sanctuary in 1987. Spread over 300 sq. km, Sona Nadi Wildlife Sanctuary covers mixed forest of dense Sal and rich bamboo clusters and is traversed by two perennial river streams – Palain and Mandal.

Our group headed for Sona Nadi under the dynamic leadership of Mr. A.S. Negi, whose years and years of experience and innovative experimentations in the field of Wildlife Conservation came into full play as he took the group via Kotdwar route, through the Kalagarh Tiger Reserve, reaching the Vatanvasa gate of Sona Nadi Wildlife Sanctuary. The gates opened before us an enchanting forest terrain, mostly explored only by serious wildlife-lovers, featuring no-where close to the popular itinerary of an average tourist!

The narrow winding dirt road through the thick forest, flourishing undisturbed in the lap of nature, mostly had a cliff on one side and a hill on the other; a situation that could become tricky if one encountered a tusker in his path! At three points our road was crossed by Palain river, when our vehicles had to traverse through the water bed to reach the other side. After the third water-crossing, we complete a nine km stretch and reached the picturesque rest house of HalduParao, which is the only forest rest house (FRH) of Sona Nadi Wildlife Sanctuary.

The HalduParao FRH, is situated on an elevated ground on the river bank, ensconced between two huge banyan trees. A classic example of British architecture, it was built in 1892 and is still standing strong after 122 years! It had two well furnished suites and a shared living room. Nearby, a more recent double-storeyed construction had provision of a dining hall and kitchen, besides two double-room accommodations. The premises were surrounded by tall trees and secured by solar-powered electric fencing. A concrete watch tower overhanging a cliff gave a panoramic view of the river and the forest with Shivalik hills as the backdrop.

Afternoon had set in by the time we reached HalduParao. After lunch and some rest, our first destination was the Ram Ganga reservoir with large grasslands surrounding the water-body. The banks were crowded by several small and large herds of Cheetals and wading birds like Lapwings, River Lapwings, Bushchats and Wagtails. The landscape was breath taking and absolutely serene.

As the sun-set drew close, we headed back to our rest house before it got dark. Halduparao FRH does not have electricity. However the rooms and the area around FRH are adequately

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lit-up by solar-powered lights that used to last the whole night and had to be switched off in the morning.

On reaching FRH, one forest guard reported that there had been a 'kill' across the river, probably by a Tiger. It was decided that we will explore the site early in the morning.

At dawn, our group assembled and led by Mr. A.S.Negi, we set ourselves on the trail of the tiger-kill. Wading through two rivulets, we came to a clear ground where a distinct smell prevailed, indicating the presence of a Tiger nearby. We reached a spot on the grass turf where a Sambhar had been killed by the Tiger, as evident by signs of struggle and bits of Sambhar fur at a couple of spots along with blood stains. From this spot, a clear trail could be seen as the Sambhar was dragged along over the grass overgrowth, to a more secluded spot, where the Tiger had finally devoured its meal. There was no trace of Tiger when we reached the spot. However, he had left evidence of his presence in the form of claw-marks on the bark of a nearby tree!

We explored further into the jungle before returning back to our rest house. However, we failed to catch a glimpse of the "King of the jungle".

HalduParao is an excellent place for bird-watching, as was evident by a wide variety of avian fauna we spotted and clicked around the FRH, river banks and the jungle trails, including a variety of Kingfishers, Woodpeckers, Babblers, Doves, Barbets, Magpie Robins, Minivets, and Munias. Storks and raptors like Crested Serpent Eagles, Kites and many Vultures were encircling in the sky. Also in abundance were Cheetals and Sambhars grazing over the grasslands and bushes, along with their fawns.

During the afternoon, we came across a group of Langurs who were licking salt off some salt rocks near the river bank. As we explored the mixed forest territory in our four-wheelers, we came across several trees laden with colorful spring blossoms.

Suddenly, we came across a Langur carcass hanging high on a tree branch. Its head and limbs along with tail, were perfectly intact and hanging from the branch in a semi-mummified state. Only the innards had been devoured. Looking at the high location and kill-pattern, where skin and limbs had been spared and only the inner organs had been fed on, we concluded that this kill was made by a Leopard, probably about two days earlier.

In the afternoon we went to Kanda watch tower situated at about 1000m over a hill from where one could get the picture-perfect panoramic view of the Ramganga reservoir and the Dhikala chaur.

Returning back for the night, Mr Rajeev Mehta caught a glimpse of an Elephant herd amidst the forest trees. Rest of us had to keep faith and console ourselves by hearing his description.

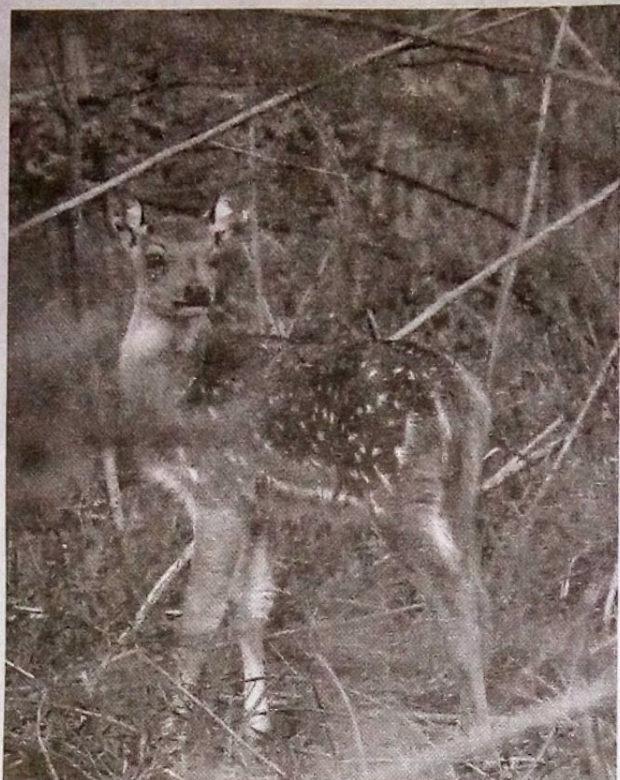
After a sumptuous dinner we were about to settle back in our comfortable rooms for the night, when we were startled by an alarm call of Sambhar just outside the FRH. Expecting a predator around, we remained alert for quite some time but there was no further sound. Out of curiosity, I looked outside my first-floor room window after a while, only to catch glimpse of a few startled cheetals being chased by couple of jackals near FRH boundary.

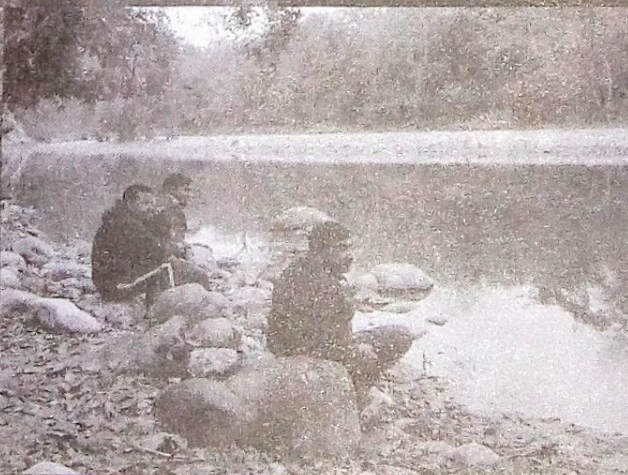
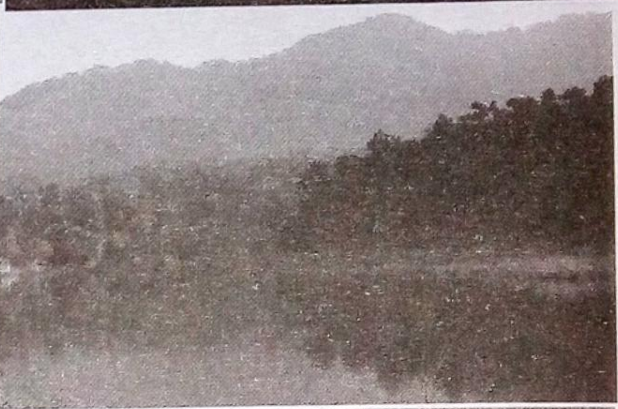
We returned back from Sona Nadi next morning, after spending two nights and days. Though we were unable to sight a Tiger or Leopard during our trip, we came back rejuvenated from the pristine and picturesque surroundings of HolduParao and thoroughly enjoyed the

explorations and excursions during the day, spiced up by scientific talks by Mr.A.S.Negi, giving us better insight of the scope of nature and wildlife conservation. Even more memorable will remain the evenings spent at FRH, sitting around fire and listening to first-hand narration of adventurous encounters with wildlife and other anecdotes by our leader Mr. A.S. Negi, whose achievements and never-dying passion for wildlife conservation is the stuff legends are made of.

Picture Credits: All pictures © Dr Dushyant Singh Gaur

1. Mr. A. S. Negi introducing the topography of Sona Nadi wildlife Sanctuary
2. The WPSI excursion team: (from left) Mr. Sudhir Raghav, Mr Rajeev Mehta, Dr Prashant Singh, Mr. AS Negi (President WPSI), Dr Dushyant Singh Gaur, Mr. SK Bannerjee and Mr Pradeep Dobhal. (Syed Mansoor Mazhar behind the camera)
3. Crossing Palain river bed to reach Halduparao FRH
4. An old tree near river bank
5. Old Halduparao FRH built in 1892, ensconced amid banyan trees
6. Dr Dushyant S Gaur (author) in front of New FRH building of Halduparao
7. Picture perfect serenity of Ramganga reservoir
8. Mr AS Negi relaxing on the Ramganga reservoir banks
9. Mr. Rajeev Mehta clicks picture as Mr. Negi looks on
10. Following Tiger's trail at dawn
11. Tiger's signature: claw marks on tree bark
12. Sounds of silence: Mansoor Mazhar, Sudhir Raghav and Prashant Singh on the serene river bank near FRH
13. Salt lick: Langurs licking salt from rock surface
14. On vigil: Crested Serpent Eagle
15. Waiting: Common Kingfisher on a lookout for prey
16. In depth search: brown-headed Woodpecker looking for insects
17. Spring Blossoms on a leguminous tree in the forest
18. The envelope: semi-mummified remains of a Langur devoured by a Leopard
19. Ignoring the trespassers: a couple of Cheetal stags
20. On alert: Mr & Mrs Sambhar
21. Lost: Cheetal fawn
22. Mother & child: Sambhar doe and fawn neat FRH
23. Beauty: Nature is beautiful in every season
24. End of day: Prashant and Negi ji lead the team back to Halduparao FRH
25. Parting shot: Sunset over Ramganga reservoir





Spatial distribution and Movement of Asian elephants (*Elephas maximus*) in Boudh Forest Division, Odisha, India.

Nimain. C Palei^{*1}, Bhakta .P Rath^{*1}, and Hanif Mohammed^{*2},

Introduction:

Asian elephant is categorized as endangered as per the IUCN red list (IUCN 2013), listed on appendix I of CITES (Convention on International Trade of Endangered Species of Wild Fauna and Flora) and Schedule I as per Indian Wildlife (Protection) Act, 1972. Movements in large mammals are considered to be one of the most important ecological factor, which influence the distribution of other small herbivores. Since elephants are nomadic in nature they travel long distance as part of their migrational activities and at the same time they stay within different forest habitats those are enriched with water and fodder species (Ritesh, *et al* 2009). Radio-telemetry of elephants in Chilla forest, the annual home range of bull and the cow was observed to be 200 Km² and 34 Km² (Joshua and Johnsingh, 1995). Elephant's home ranges were estimated to range from 188 Km² to > 400 Km² but no differences were found between male and female home ranges (Williams, 2002).

In Kuppam, Palamaner, Gudiyattam, Panganur and Bangarupalayam (south India) elephant's home range was estimated to 409 Km². Similarly, a study in south India estimated the home range of elephant's herds to be 105 Km² and 115 Km² (Sukumar, 1989). Home range size of two different Herds was estimated to be 34.7 Km² (dry season) and 87.2 Km² (wet season) and 81.3 Km² (dry) and 46.1 Km² (wet) in Parambikulam Wildlife Sanctuary, south India (Easa, 1988). Movement of elephants in Dudhwa National Park has been also seasonal and erratic. Animals of the western Nepal population range south along the Karnail river from the reserve to a patch of riverine forest across the border along India (Javed, 1996). The home range estimated to be 258.6, 3343.1 and 4348.9 Km² for three different bulls in Dalma Wildlife Sanctuary and Chhotanagpur Plateau (central India). Study also highlighted that home ranges expanded to be maximum in winter and shrunk to minimum in summer (Datye and Bhagwat, 1995).

Study Area: The Division lies in Central Orissa, to the south of the Mahanadi River, which forms the western and northern boundary of the district. Across the Mahanadi lay the districts of Bolangir to the west, Subarnapur to the northwest, and Angul to the northeast. Nayagarh District lies to the southeast, Phulbani District to the south, and Kalahandi district to the southwest. Geographically the Boudh district extends from Latitudes 20°22' to 20°50'N and Longitudes 83°34' to 84°49'E. It is bounded by River Mahanadi & Angul

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District to the north, Kandhamal District to the south, Nayagarh District to the east and River Tel & Subarnapur District to the west.

Methodology: The data collected was as part of the animal monitoring activities and the daily record was based on direct sighting of animals, indirect evidences like feeding sign, footprints impression time and fresh dung piles. The direct sighting were noted in duly prepared Performa, recording the Herd composition, age and sex, if observed in Herds and also the place of sighting, time and vegetation type. Field binocular was also used for observing their movement behavior without disturbing the animal from an adequate and safe distance.

Result and Discussion:

Herd Movement: A group of elephant consisting of 15 nos.(Table-1) were found present in Jagannath Bana Prakalpa plantation near Tel River on 14th November 2013. It was ascertained that this group of elephants have come from Phulbani Division through Kantamal Range of Boudh Forest Division.

However on 15th November 2013 they were found in the middle of Mahanadi River (N 20° 49' 59.2" and E 083° 56' 25.2") while crossing the said river. The entire staff of this division were vigilant and watching the movement of elephants from the river embankment. The movement of elephants was observed till evening and it was ascertained that they have crossed the Mahanadi River and proceeded towards Subarnapur Forest Division or to Rairakhol Forest Division. But it was noticed that crackers have been used continuously from other side of the river by the staff of Subarnapur Forest Division to divert the direction of the movement of elephants. However till night it was felt that the group of elephants might have crossed the river.

Table 1. Composition of elephants in herd in Boudh Forest Division

Adult Males.	Adult Females	Sub-adult Females	Juvenile Males	Juvenile Females	Calves	Total
1	5	2	2	2	3	15

On 16th November 2013 morning again it was found that the same herd above said group of elephants were standing in the mid of the River Mahanadi facing towards Boudh Forest Division. Their movement was watched very closely and it was noticed that they were slowly moving towards Boudh (in reverse direction/reverted back) as heavy crackers were used to drive back the elephants from other side of the river i.e. Subarnapur Division. Under such circumstance the above said group of elephants moved towards the river bank of Boudh

and they were supposed to cross the N.H. 57 and proceed towards Kantamal Range through various villages of Manamunda Range. All efforts were made to disperse the gathering of people to avoid any untoward incident. The N.H. 57 has to be blocked so that the group of elephants can cross the road smoothly without causing any harm to public. This fact was intimated to Collector and Superintendent of Police, Boudh for information and necessary help. The police force from Manamunda Thana has reached the spot immediately and with the help of forest staff the road was blocked at 4.30pm. At the same time the Executive Engineer, South-Co. and other staff of their department were informed immediately to disconnect the flow of electricity in and around Manamunda. The above said group of elephant crossed the N.H. 57 at about 5pm (N 20° 49' 49" and E 83° 56' 29.2") and proceeded towards Khairmal village.

Immediately we proceeded to Khairmal village and it was learnt that above said group of elephant are present nearby Saraswatipur village. From their movement it was presumed that they were moving towards Panchara R.F. or towards Penajore R.F. In their course of movement they were supposed to cross Bahalpadar, Kaliamunda, Uchhabahal, Gudvelipadar, Jampali, Jogipadar, Bichhanapati, Bhaliapadar villages. And the behavior of elephants was quite normal and the people of Khairmal, Saraswatipur, Jampali, Bichhanapati etc were not at all panic about the presence of elephants in nearby place. Till date this group of elephant has not caused any harm to the life and property of any villagers. No house damage was noticed or reported from any villagers only damage of paddy crop has been noticed.

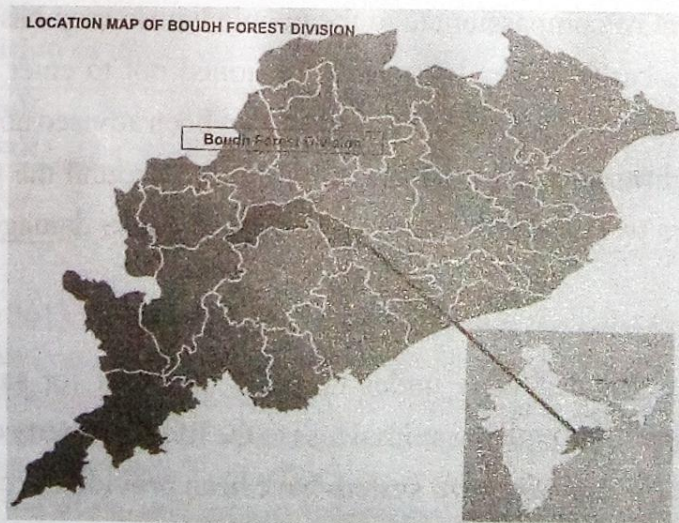
It was found that the people of above said villages neither aggrieved nor aggressive regarding the presence of elephants. They were not at all hostile towards the elephants rather they agreed to tackle the presence of elephants with patience. However the people were asked for payment of compassionate to the people whose crop has been damaged as per government norms earlier. They have been cautioned not to enter inside the nearby forest in the darkness or in early morning. They have also been advised not to come out from their house during night time and lit fire on certain points around the village so that the elephants will not dare to come close to the village and cause damage to their life and property.

The various modalities that were under taken by the staff for safe passage of the pachyderms to their habitat causing animal loss to the life & property of the people.

1. Round the clock watch and ward system have been provided to closely monitor the

movement of elephants and to keep vigil eye on them so as to take full precautions to safe guard the life and property of the villagers and also give protection to the life of the pachyderms. For above said purpose a monitoring team consisting of forest personnel and anti-depredation squads were entrusted with the work found. In the above said team the Range officer Manamunda Range has been made leader along with other mobile staff of this division.

2. Different type of posters have been provided to the monitoring team "Do" and "Don't" with respect to the presence of elephants for awareness purpose. The members of monitoring team were instructed to paste the above said posters in the villages.
3. A command/movement register has been made wherein the movement of elephants, signature of the team members on duty and other relevant information shall be maintained on daily basis.
4. An awareness register has been made where-in the proceeding of each meeting shall be written on daily basis. The monitoring team has been instructed to conduct the awareness meeting in each nearby village where elephants are present on daily basis. The villagers should be made aware of the fact of presence of elephants and advised to safe guard their life and property.
5. The monitoring team will also try to drive away the elephants to their natural habitat in appropriate time and condition.
6. The monitoring team has been instructed to dissuade the villagers to cause any harm or irritate the pachyderms.



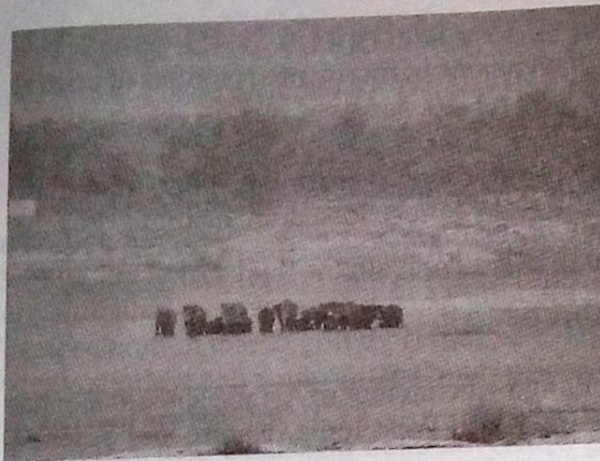


Figure-1 Elephant in Mahanadi River.

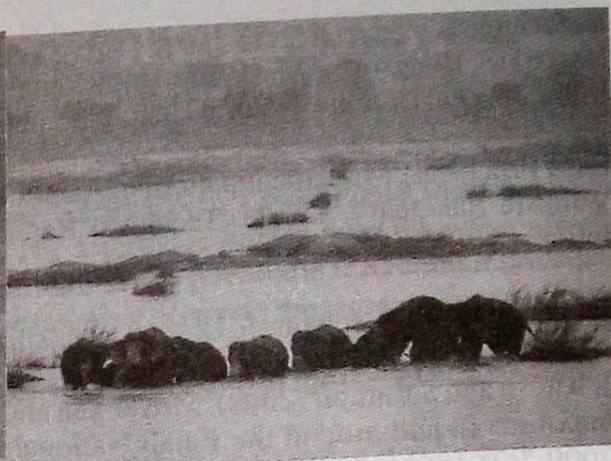


Figure-2, Elephant in Mahanadi River.

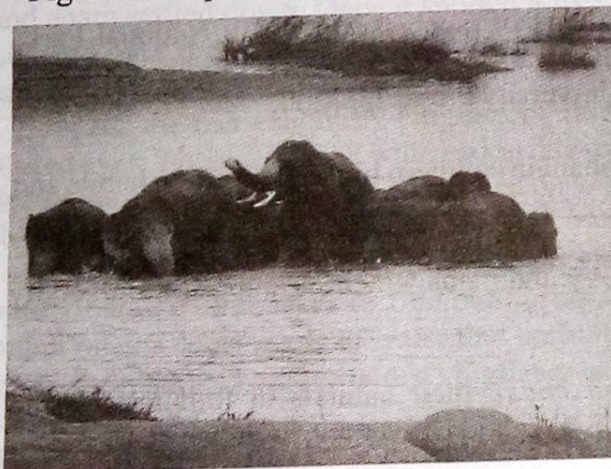


Figure-3 Elephant in Mahanadi River.



Figure-4 Elephant in Mahanadi River.

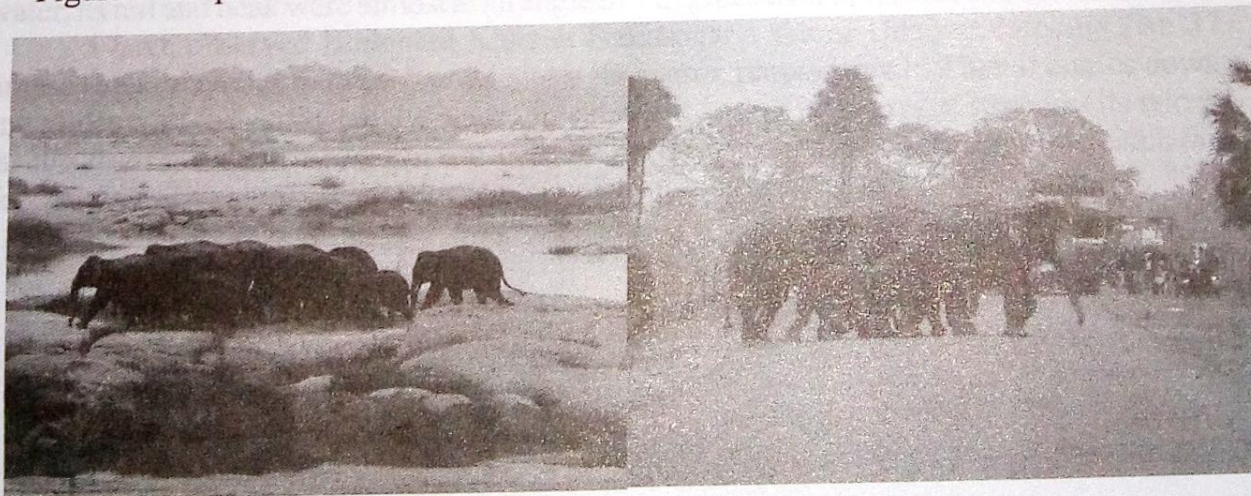


Figure-5 Elephant in Mahanadi River

Figure-5 Elephant Movement towards
Boudh Forest Division

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Lesser Pied Kingfisher (*Ceryle rudis*) and Brahminy Kite (*Haliastur indus*) Overcoming Refraction

Raza H. Tehsin

I have closely and keenly observed around 313 attacks by Lesser Pied Kingfishers to catch fish around Udaipur in Rajasthan, India. The kingfisher hovers over the water after locating the fish, which are playing almost at the surface. To overcome refraction it hovers perpendicularly above, so that it can pinpoint the target. It drops on the target using gravity. The acceleration due to gravity is the speed attained by the attacker. Whenever it finds that water is shallow and it may hit the bottom, it reduces its height so that the velocity is less and it doesn't hit the bottom.

Once near Udaisagar Lake's overflow gates in Udaipur, in a pool of water some fish were playing near a submerged boulder. Periodically, the kingfisher flew over the boulder and again settled down. Once it spotted a fish about two meters away from the boulder. It hovered over it and dived down to catch it. How they gauge the depth of the water is a mystery.

All the fish caught by kingfishers, during my observations, were having laterally placed eyes. These fish have wide vision due to this, but there is a range just above the head where the fish can't see. The kingfisher makes use of this dark spot of the fish vertically above its head and attacks it likewise.

Near our house in Panchwati, Udaipur, there is a nullah which carries the excess water of all the three lakes of Udaipur during the rainy season. After the rainy season, the nullah retains some pools of water that harbour variety of fishes. There is an electric wire across the nullah. Over this wire a kingfisher used to perch. Whenever there was a fish right below its perching position, it dropped down and caught it. Fortunately, I took three videos of its diving attack. It enters the water with its velocity and weight. When I looked at the videos in slow motion, I found that in all the three videos when it just emerged out of the water, its tail and beak were almost at an angle of 7 degrees with the surface of the water.

I have observed Brahmani Kites at Fatehsagar Lake of Udaipur catching fish 37 times. The kite circles in the sky and locates its quarry, pinpointing it. Then it comes down and glides over the surface of the water. Whenever it is near its quarry, it stretches its talons far ahead so that when its eyes are vertically above the target, the talons are ready to catch the fish. The refraction is overcome due to vertically spotting the target.

मादा पैंथर को मारकर पेड़ पर 50 फीट ऊपर छोड़ भागा नर पैंथर

भारत न्यूज़, कलकत्ता (असम)

खैरबाड़ा तालुका क्षेत्र के रजोला वनोद्याय में रहित सुबह मादा पैंथर का शव 80 फीट ऊंचे पेड़ के पेड़ पर 50 फीट की ऊंचाई पर पड़ा मिला। पैंथर की मौत शिकार को लेकर आपसी झगड़े में हुई। पोस्टमार्टम रिपोर्ट में मृत पैंथर के गले पर दाँत के निशान मिले हैं। हमलावर पैंथर ने ही उसे पेड़ पर दो टहनियों के बीच सुरक्षित जगह ले जाकर रख दिया ताकि वो उसे बाद में खसक सके। गाँव के सरपंच पति फूलचंद मीणा की सूचना पर पहुंचे वनकर्मीयों ने पैंथर के गले में रस्सा डालकर नीचे उतारा। दूसरे पैंथर के खून से भरे पद चिह्न पेड़ के तने और टहनियों पर मिले हैं। वन अधिकारियों के मुताबिक दूसरा पैंथर आसपास के क्षेत्र में ही है।

शेष पेज 7

पोस्टमार्टम रिपोर्ट

असम का अधिकारी शिवोदय राय के मुताबिक पेड़ के तने पर मिले खून के निशान से पैंथर की मौत की पुष्टि हुई है। मृत्यु पर की गई हत्या के निशान मिले हैं जो मृत्यु की शक के साथ ही मौत की पुष्टि करते हैं। वन पैंथर के घेरे में खसकने का मोह भी मिल है। इससे से पहले उसने खसकने का प्रयास कर चुका था।



यूँ उतारा

शिकार को पेड़ पर सुरक्षित रख सकता है पैंथर

वन संरक्षक सतीश कर्मा ने बताया कि पैंथर द्वारा किसी भी शिकार को मारकर पेड़ पर सुरक्षित रखे जाने की हम 'नोटिस' रखते हैं। इसकी सीखने की ताकत बहुत ज्यादा होती है जो अपने से ज्यादा भारी शिकार को अपनी से कहीं भी ले जा सकता है। हथकड़ी, गोदड़ व गिराव से बचने के लिए पैंथर अपने शिकार को पेड़ पर लटकाकर किसी जगह से जाकर सुरक्षित रखता है।

सवाल

क्या पैंथर के शव को गले में फंदा डालकर नीचे उतारा जा सकता है?

वन संरक्षक सतीश कर्मा बताते हैं कि किसी भी वन्यजीव के शव को पेड़ से उतारने के लिए वन में बिछावने के लिए यहां की स्थिति पर निर्भर करता है। पैंथर अपने शिकार किसी जगह जगह बिछा कर वहीं रहता है। ऐसे में नीचे पद जो भी बिछाव लेते, उतारे जा सकते हैं। वन्यजीव को ज सकनी है।

पैंथर को उतारने पेड़ पर चढ़ा जा सकता है।

Misogynism in Tiger (*Panthera tigris*) and Leopard (*Panthera pardus*)

Raza H. Tehsin

Key Words: Tiger, Panther, Big cats, Misogyny

Attached News item: Dainik Bhaskar dated 3rd Feb 2014

The following three instances point towards misogynistic behaviour in big cats.

In the late 1970s, a tigress was brought to Udaipur zoo for the lone male tiger of the zoo as a mate. After a rest of two days both were put in the same enclosure. They started fighting vigorously. With long bamboo poles and finally with the help of a fire brigade the staff of the zoo managed to separate them and put them in different enclosures.

After the lapse of some days a high ranking forest official from Jaipur visited Udaipur. While inspecting the zoo, he inquired with the in charge of the zoo about the male and female being in different enclosures. The in-charge explained how they had fought narrating the above incident. The official ridiculed the staff and insisted on putting the tiger and tigress in the same enclosure again in his presence.

When they were put together, the tiger mounted on the female and gripped and twisted her neck. Within minutes the tigress died. He was reluctant to leave the carcass of the female but once again with the help of bamboos and fire brigade they managed to put the male in another enclosure and take the dead tigress away.

In early 1980s, a pantheress was found dead in Kumbhalgarh Wildlife Sanctuary. Near the carcass pugmarks of an oversized panther were seen. Post mortem was conducted on the carcass. Apart from four clean punctures on the lap of the pantheress, no other injury was found. The pantheress' vertebra of neck was broken.

On 2nd Feb 2014, a carcass of a pantheress was found on a Mahua tree (*Madhuca indica*) about 50 feet from the ground (*Please find the news item attached: Dainik Bhaskar dated 3rd Feb 2014*). In the inquiry made by the author, the forest officers informed that the pug marks of a male panther were found near the tree. Apart from four punctures on the throat, no other injury or disease was found on the carcass during autopsy. Autopsy says that pantheress died due to suffocation. After killing the pantheress, the male took the carcass over the tree. This shows that it intended to devour the carcass the next night. It may be indicative of cannibalism.

Shikra (*Accipiter bodius*) Preying on Bat

Raza H. Tehsin

I stepped out on the lane from my house at Panchwati, a colony in Udaipur Rajasthan, on 7th May 2013 at about 11.15hrs. There is no traffic on this lane as it ends at the nullah that carries the excess water of Udaipur lakes. There are lofty trees on both the sides of this path. In the lane, I heard a loud “chi...chi...chi...” I began to look for the source of this noise on one of the trees but I was unable to locate it. After a couple of minutes, a shikra emerged from the dense foliage of the tree on a comparatively bare branch with a bat in its talon. The source of the noise was the bat and it continued shrieking. The shikra pierced its beak twice into the bat, which then stopped making the noise. Then the shikra started eating it. I couldn't identify the bat, but from its size it seemed like a Pipistrelle (*Pipistrellus coromandra*). Within 10 minutes it had devoured the bat. Not a single part of the bat fell down, and everything was gulped including the nails.

Probably this is the first instance in which a shikra is seen eating a bat.

The attached photograph is taken by Anil Rogers.



Sloth Bear (*Melursus ursilus*) Suckling its Forepaw

Raza H. Tehsin

I was camping at Kumbhalgarh Wildlife Sanctuary of Rajasthan in the summer of 2007. My camp was near Thandi Beri. Because of the hot weather the water was scarce and remained in small pools. Leaves had fallen and thereby the visibility was good in the jungle. One night, on 2nd May, I was sitting over a waterhole to watch the movement and behaviour of animals. It was a full moon night. At about 2300 hours a sloth bear appeared on the waterhole. It quenched its thirst and shuffled towards a mound of white ants. It seemed the mound was already dug out. The bear vigorously started digging it further. Suddenly it howled and sat back on its haunches. Taking its right forepaw in its mouth it started suckling for five whole minutes by my watch. After that it slowly moved away and disappeared in the night jungle.

I witnessed a similar instance in the year 2008 when I was camping in Sumer, a small village with a forest rest house at the periphery of Kumbhalgarh Wildlife Sanctuary. There is a temple about two kilometres inside the sanctuary where they've built a *piyao* (water trough) for cattle and wild animals. It was a promising animal path. The wild animals would pass by and stop to quench their thirst. I sat in a hide near this animal path. In front of me there were three large trees on which hung twelve bee hives. At about 22.30 hours a sloth bear came down the animal path. It stopped near the trees which harboured the bee hives. After sniffing for some time it climbed the tree and disappeared from my sight in the dense foliage. Within a few minutes, it fell on the ground with a thud. It howled sitting on the haunches and then put its right paw inside the mouth and suckled it for 12 minutes.

Long back, the team from Udaipur zoo including myself had trapped a sloth bear at the foothills of Mount Abu for Udaipur zoo. As a member of Zoo Advisory Committee, I went often to see how the sloth bear was faring. One day when I went to see its condition, I found it was sitting on its haunches and suckling its right paw for over 20 minutes in a dark corner of the cage.

Due to injury or frustration of not getting food, when in seclusion sloth bears tend to suckle their forepaws. It seems they do this to ward off frustration.

ECODEVELOPMENT : Managing The People for Wildlife

Dr. S.P. Singh* and Dr. Vijay Laxmi Singh**

To many people, the need to conserve wildlife and avoid environmental degradation is undeniable. For others, though, have questioned the value of conservation. In particular the justification for financial investment in species and countryside conservation has been challenged. Policy decisions are overwhelmingly matters of economics. Yet standard economics has failed to assign more than nominal value to ecological resources.

Developing a new ecological or 'green' economics is an important contemporary challenge. This may be relatively straightforward for species with obvious resource value such as crop plants or plants with known medicinal use. It is much more difficult for species with only indirect or potential value, for example as a tourist attraction or as part of a landscape in a National Park or as an essential but unattractive decomposer organism.

It aims at economic development in harmony with ecological balance and the betterment in the quality of life of our people. This development is without destruction but through active participation of public in general. The student community could be the major component of the work force which needs to be trained and geared to take eco-development programmes based on learning by doing. To create awareness among the students, the 6th five year plan included participation of university and scientific institutions in National Development with three point strategy –

1. Creating awareness in youth for conservation and enrichment of environmental assets through learning by doing. These programmes should be given proper academic recognition and credit thereby generating a new value system in educational programme.
2. University Research Programme should increasingly come close to local environmental upliftment.
3. Universities located in some biogeographical areas should participate in coordinated ecodevelopmental programmes as action research.

Ecodevelopment programmes opens up vast opportunities for employment generation for the youth, provided following modifications are incorporated in the existing university syllabus and curriculum :

- (a) Give academic credit to ecodevelopment programme and field work.

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(b) Under this programme, there is a shift in research priorities with emphasis on application rather than pure research.

Involvement of non-university youth and the public in programme of ecodevelopment can be ensured by exploring the possibility of taking up ecodevelopment programme under the "employment guarantee scheme".

In Maharashtra, the tree plantation taken up during ecodevelopment camps held by university students is maintained and looked after during summer resort by casual labourers employed under the Employment Guarantee Scheme. This constructive participation of students and daily wage labourers provides an example of collaborative efforts.

Ecodevelopment programmes should involve local residents projects involving women in particular have met with tremendous success in **Chipko Movement** (hug the tree movement in Himalayas) and also "Bishnoi's" in Rajasthan several hundred year ago. In the programme, the non-government organisations and other voluntary bodies can render excellent help in participatory community and social forestry, the Government agencies should ensure all help for such activities.

Youth graduating today come to the University with hope and aspiration and having university with expectations. While these youths have own set of expectations, the society has right to share the fruits of their training. Therefore, there should not be any hesitation on the part of educated youth to remove ignorance and illiteracy in whatever way they can.

Our immediate need is to ensure ecology and eco-development in a manner that these have self rectifying capacity so that our life system (air, water, land, flora, fauna) is not strained beyond measure.

Since, resources are limited one would like to commit these for the most important and genuine problems, for e.g. if the choice between desert area adjoining area or between Himalayas and the adjoining plains, priority must go to deserts and Himalayas because if we control damage in the desert and hills, we automatically set right the damage in plains.

For any eco-development programme, objective should be very clear and precise and must have a commitment involving the villagers who in the ultimate analysis are both the end users and the guardians of our ecology. There is no actual dearth of plans but the time has come for implementing and translating them into reality. For this, crucial role can be played by students and non-governmental organisations as vehicles of change because the diversity and dimensions of problems are such that no government can afford the money and infrastructure to undertake eco-development. Therefore, there is no more need to impart knowledge and training in ecology and ecosystems by holding development

camps and by initiating small research projects. In a short time such a network could become an excellent monitoring system for measuring the extent and the nature of ecological damage and also act as an early warning system of an impending ecological damage. For this we should need ecological kits for eliminating damage to air, water and land for which non-government organisation could be catalyst between government, on one hand and students and people on the other. For sustained growth, eco-development should be based on scientific principles.

Due to an increase in population and escalating demands or account of accelerated development needs, there is considerable pressure on land because our country had very high man and land and animal and land ratio. Thus, we should turn our attention to less fertile and poor soils which are at present lying untilld on uncultivated. Nearly 07 million hectares of such land in the country is saline and alkaline (Usar) and has been regarded as unfit for agriculture on account of high concentration of soluble salts, pH upto 11, a layer of CaCO_3 concentrated upto a depth of 01 metre. Soil suffers from water logging and is impermeable. Every year, country is facing additional substantial damage to such land on account of salinisation due to irrigation nand development activities including raining. Development of all such land is immnediately required to release pressure on our cultivated land. Because of severe soil and climate constraints all such lands have not been put to any productive use so for. Starting eco-development week under such conditions is not only a major challenge to research and development (R&D) but require conviction, dedication on the part of those who were to run the project.

The Usar (barren land) supports very sparse vegetation. A moderate rainfall or light irrigation creates a situation with micro run-off and micro-erosion from high to lower spots. Thus, it makes the whole area ecologically intolerable to most plants. Such a saline-alkaline barren land has been called Halosers.

Essentially, there are two approaches to the eco-development of usar land :

- (i) Either by improving land and planting high yielding crop species or
- (ii) by screening and identifying from amongst the existing species or even by designing new ones that can tolerate salinity.

The later alternative is relatively for less costly and in course of time due to litter fall and its consequent decomposition and mineralisation even improves the soil.

The utilisation of halospheres was possible through a series of well conceived essentially low cost, successional stages and utilization of biomass amendmets (i.e. contour binding, digging pits, breaking hard pan and filling the pits) and cultivation of

tolerant species followed by irrigation. As soon as the plants were established they contribute to the physical, chemical and biological changes in rhizosphere.

During 1956 to 1983, there developed a manmade forest leading to a terrestrial mini-ecosystem inhabited by wildlife of a number of small mammals, birds, reptiles, amphibians, fishes and insects. The tolerant trees and shrubs improved the soil and made it hospitable for less tolerant species. Thus, a piece of land that was totally barren and waste is converted into a self sustaining green patch with a top storey of trees, middle of shrubs and ground of cover of herbs.

With the accumulation of litter and organic matter, there follows a decomposer succession leading to soil development. This makes it possible for new plants to invade. Apart from the plant communities, there are decomposers, earthworms and wildlife.

The cropland ecosystem has also been developed utilising a mixture of food, oil and aromatic plants that are tolerant to salinity. Thus, halosphere has given rise to cropland, grassland and woodland. The rainwater when impounded in artificial bodies and planted with *Salix*, *Typha*, *Trapa*, *Nelumbo* and *Nymphaea* associated with fish and prawns lead to the development of aquaculture. All these systems if managed on ecological principles can be utilized for direct and indirect benefits in human society.

A number of trees of ornamental value have done well and can be used for beautifying the Usar land. In short, the dusty land has been made very aesthetic and pleasing.

My Visit to the Ranganthittu Bird Sanctuary

By: Komal Shah

Between Bangalore and Mysore lies the famous Ranganthittu Bird Sanctuary in the Mandya District of the state of Karnataka in India. It is the largest bird sanctuary in the state, which is spread in about 40 acres and comprises of six islets on the banks of the Kaveri River. Ranganthittu is located three kilometers away from the historic town of Srirangapatna and sixteen kilometers from Mysore. The sanctuary attracted about 2.90 lakh visitors during 2011-2012, which shows its nobility as an important bird sanctuary in India.

The islets came into being when an embankment across the Kaveri river was built in 1648 by the then Mysore King, Kantirava Narasimharaja Wodeyar. The ornithologist Dr. Salim Ali observed that the isles formed an important nesting ground for birds, and persuaded Wodeyar Kings of Mysore to declare the area a wildlife sanctuary in 1940. The Forest Department of Karnataka State is maintaining the bird sanctuary and puts its efforts to improve the sanctuary, which include purchase of nearby private lands to expand the protected area.

Roughly around 170 birds have been recorded here in great numbers over the years. Of these, birds like Painted Stork, Asian Openbill Stork, Common Spoonbill, Woolly-necked Stork, Black-headed Ibis, Lesser Whistling Duck, Indian Shag, Stork-billed Kingfisher and other common birds like Egrets, Cormorants, Oriental Darter, and Herons breed here regularly. The Great Stone Plover, and River Tern also nest here. The park is home to a large flock of Streak-throated Swallows. During the months of January and February, more than 30 species of birds are found and the season of the sanctuary is from November to June. About 50 pelicans have made Ranganthittu as their permanent home.

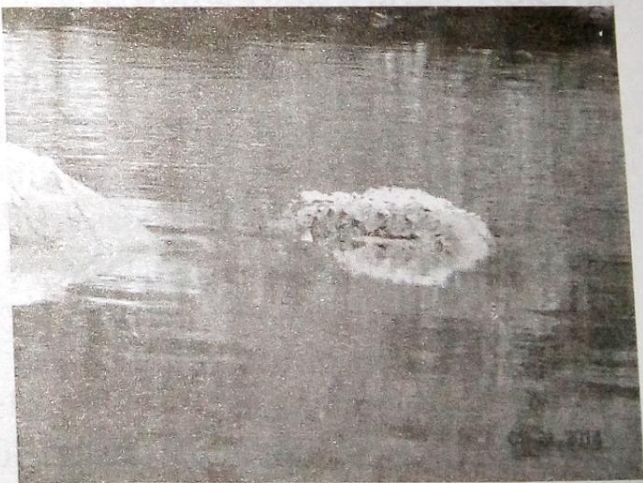
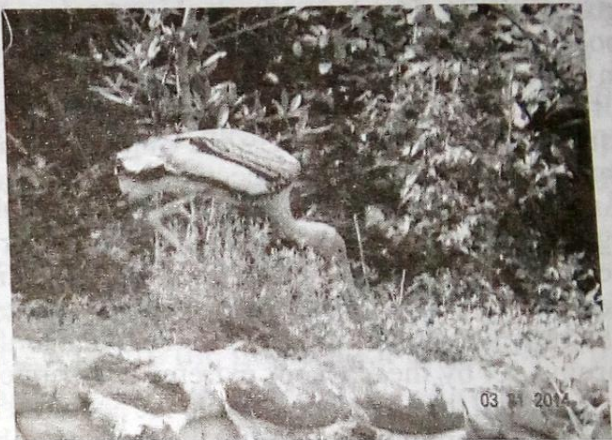
During winter months starting from mid-December, at certain seasons, as many as 40,000 birds congregate in this bird sanctuary and some birds come from Siberia, Latin America and parts of north India. It is a popular nesting site for the birds and about 8,000 nestlings were sighted during June 2011.

The islands are host to numerous small mammals, including Bonnet Macaque, colonies of Flying Fox and common small mammals like Common Palm Civet and Indian Gray Mongoose and the Monitor Lizard. The Mugger Crocodile or the Marsh Crocodile is a common inhabitant of the riverine beds and the Ranganthittu has the largest fresh water crocodile population in Karnataka state.

Ranger-guided boat tours of the isles are available throughout the day, and are a good way to watch birds, crocodiles, otters and bats. There are no lodgings at the tiny sanctuary, so visitors typically have to stay over at Mysore or Srirangapatna. The seasons for visiting the

park are: June-November (during the nesting season of the water birds). The best time to watch the migratory birds is usually December but it can vary year to year. The Salim Ali interpretation Centre, maintained by Forest Department, screens 45 minute documentaries to special interest groups.

The best part about the bird sanctuary was that it was maintained in a very clean and green manner and I feel other National Parks and Sanctuaries must learn from it. It was an awesome sight to see the birds and the marsh crocodiles in their natural habitat. It is a must see for all nature lovers and how I wish schools could take us to such breathtaking parks and sanctuaries across India. Yes I have decided to come back again to the Ranganthittu Bird Sanctuary!!!



Climate change to worsen floods, hunger: UN

Yokohama: Soaring carbon emissions will amplify the risk of conflict, hunger, floods and mass migration 1 this century, the UN's expert panel said on Monday in a landmark report on the impact of climate change.

Left unchecked, green-(house gas emissions may cost trillions of dollars in 1 damage to property and ecosystems, and in bills for shoring up climate defenses, it said, adding the impact would increase with every additional degree that temperatures rise.

"Increasing magnitudes of warming increase the likelihood of severe, pervasive, and irreversible impacts," a summary said, in a stark message to policymakers.

The report is the second chapter of the fifth assessment by the Intergovernmental Panel on Climate Change (IPCC), constituted in 1988 to provide neutral, science-based guidance to governments. The last overview of the panel, published in 2007, unleashed a wave of political action that at one point appeared set to forge a worldwide treaty on climate change in Copenhagen in 2009.

Ut a global consensus failed to emerge as the developing world and developed world squabbled; with big polluters like China insisting it was up to rich countries to take the lead, arguing they could not be expected to sacrifice growth.

And in the United States, President Barack Obama's attempts at passing climate change legislation have been stymied in Congress, where some Republicans remain unconvinced of the scientific case for warming and argue that mitigation efforts are an unnecessary block on economic growth.

The new document, unveiled in Yokohama after a five-day, meeting, gives the starkest warning yet by the IPCC of extreme consequences from climate change, and delves into greater detail than ever before into the impact at regional level.

It builds on previous IPCC forecasts that global temperatures will rise 0.3-4.8 degrees Celsius (0.5-8.6 degrees Fahrenheit) this century, on top of roughly 0.7 Celsius since the Industrial Revolution.

One Shot is not enough-TIGER

A. Imam,
Hazaribagh, Bihar.

A tiger is the world's most powerful cat, the lion excluded. If a domestic cat, has nine lives, then a tiger ought to have as many too and a few to spare. And in this tiger does not disappoint us as far as this attribute is concerned.

Tiger are frequently shot down in their tracks with well placed bullets from comparatively low powered rifles. My friend Raja of Kunda once shot down five tigers in one beat a few miles away from Hazaribagh using a .30/06, and that too loaded with 150 grain solids. I know of at least three cases in Hazaribagh districts where a tiger has been hacked by a single blow of a "tangi", the jungle man's narrow bladed axe. One of these cases involved the notorious Giridh man-eating tigress which thus met its end a decade or so ago. But the foregoing descriptions should not be taken to infer that low or medium powered rifles are all that are necessary for shooting down a tiger.

From time to time I have met, or heard of small bore enthusiasts who having shot a few, or perhaps even a dozen, tigers with the greatest of ease, using their pet weapons, then proceed to generalize from the particular and insist that all that is required is accuracy of shooting, when their comparatively low powered weapons are supposed to be adequate. One can make no greater mistake, which may prove fatal in the most sense of the world, as Burrard puts it in his "Notes on Sporting Rifles".

"The heavy medium bores would probably prove perfectly satisfactory in at least nine cases out of ten cases. But when venturing to offer a piece of advice I cannot forget the possible tenth probability. The value of bullet weight in the tiger shooting is beyond doubt, and for this reason I believe that a heavy double, firing a bullet of at least 480 grains, is the best weapon, it may be a bit heavier, but that little extra weight may be worth carrying to save a human life....."

The above is with reference to weapons for use in dense jungles on animals including the big cats. Burrard classifies weapons such as The 0.425, 0.416, 0.404 and 0.450/0.400 as heavy medium bores. If even these weapons are not quite suitable, there is little to be said for the medium and small bores, magnum or otherwise.

As animals go, even considering the soft skinned carnivora only, Indian tigers are not particularly big animals. A tiger is only about half as big as, say, a

This article first appeared in CHEETAL Vol.6 No.1 Published in October 1963.

Kodiak bear. Considering this, his vitality is almost incredible. I have seen a tiger come out in a beat and receive a 0.500 grain 0.570 bullet in the shoulder and yet able to gallop away from the scene safely. A second shot, from 0.375 magnum, took it in the neck, missed the spine but raked down into the heart. Both bullets shot at ideally. Yet that tiger charged a "machan" and was only stopped in the nick of time by a 0.375 bullet-which broke its neck.

Last year in May my client Mr. Floyd D'Angelo of Los Angeles shot a tiger in a beat, putting a 0.425 magnum 400 grain bullet first through its heart, then another through both lungs and finally a last one through both front legs. That tiger went past at a gallop and only dropped dead some 60 yards away from the "machan". If it had turned back towards the beaters it could have inflicted serious injuries before dropping dead. The bullets were Westley Richards pointed capped which expand very rapidly. The contents of the chest cavity were a mush, with disintegrated heart and lungs.

Last year in November a tiger came out in a beat and gave my client Mr. R.L. Phipps of New York an opportunity to shoot from a 15 yards range. Phipps and I were standing on the ground. His 0.465 bullet was perfectly placed through the animal's heart, and though it knocked the animal down, it rose at its feet and went 150 yards before dropping dead. I am convinced that if a light or medium rifle had been used in this case, either we or the beaters would have been in trouble, for the animal would not have been dazed by the great shock of the 0.465. In this instance the beaters were close behind the tiger.

Head shots, even with heavy cordite rifles, do not necessarily floor the animal. This is surprising, as generally a 0.470 class bullet will drop an elephant, albeit temporarily with a head shot which misses the brain. Here are a few cases.

Col. Powell in his book "The Call of the Tiger" recounts how he shot a tigress just below an eye, head on, with 0.470. The animal was in a state of shock for about a few moments, but was not totally knocked out. Col. Powell followed up immediately and gave it the last fatal blow. He was of the opinion that if he had put off the chasing the animal till the next day he would have created a nasty, dangerous animal on his hands. Col. Powell also recounts how he shot a tiger between the shoulder blades with a 0.470, yet the tiger did not drop or even later die of the wound, and had to be followed up and killed.

The late Jim Corbett describes in one of his books how he shot the well known tiger called 'The Bachelor of Powalgarh'. He fired at this animal while he was himself lying down on the ground using a 0.450/0.400 gun which, of course,

throws a 400 grain bullet with some 4,000 ft. lbs. muzzle energy. He hit the tiger an inch below the right eye at a range of ten yards. Instead of it dropping dead as Jim Corbett expected, the tiger jumped straight into the air for its full length and then commenced to attack with dreadful fury a fallen one foot thick tree which it tore to bits. Corbett followed up and eventually shot this tiger, but only on the fourth day after wounding it. The first bullet was found to have blown out a piece of the back of its skull.

Major Henry Shakespear, author of the "Wild Sports of India" written in the last century, tells how he shot a galloping tigress *through the brain* with a 10 gauge black powder rifle at five yards range, yet the animal went on apparently unaffected for forty yards before collapsing dead. Elephants shot through the brain with small bore rifles have been known to go some distances before dropping, but there is no case on record where an elephant has taken a 10 gauge rifle bullet in the brain and not collapsed immediately.

Dunbar-Brander, in his "Wild Animals of Central India", recounts the remarkable case of the tiger shot by H.R.H. the Duke of Connaught at Supkar in 1921. The animal was shot through the head with a heavy h.v. condite rifle. It fell down in its tracks, but later recovered and escaped. Dunbar-Brander eventually came up with it *seventeen* days later. It had been living in water to ease the irritation from maggots which had formed in the wound. The original bullet was found to have entered slightly below the left eye and blown out the teeth of the upper jaw, smashed the lower one, and dreadfully lacerated the gullet. In spite of this wound which prevented it from eating for seventeen days, that tiger was active as ever and ready to charge.

I myself had a remarkable experience only last month. A tiger came out in a beat allowing me the opportunity to make a head shot, which I dislike. However, I fired and my 0.470 bullet took it in the exact centre of the nostrils, raked down through the neck, the pericardium or outer casing of the heart, one lung and into the liver. The animal never even flinched and got away for the time being. The tracking of the beast had to be prolonged into the forest, when buffaloes were put in ahead of me. The buffaloes moved the tiger on, and it eventually died of the exertion nearly 24 hours after first receiving this fatal wound.

So much for head shots, though the last case also deals with vital wails such as the heart, lung and liver. In case of readers being sceptical about this case, I

shall remind them that human beings shot through the pericardium or outer casing of the heart have been known to survive, and that a friend informs me that a doctor friend of his is of the opinion that injury to only one lung would collapse it and permit the animal to live for sometime on the other lung. As for the liver damage, Dunbar-Brander records a case of a tigress being shot in the region of the diaphragm with a 0.577 which remained a nasty, active animal to kill even eleven days after, during which period she had not eaten anything. Presumably there was liver damage in this case.

Possibly the most remarkable case of all is that of the tiger shot by Mr. P.H. Sykes in Bastar during the early 1930s. This tiger took a 0.577/0.500 (low pressure cordite rifle) bullet between the shoulder blades near the base of the neck. The bullet raked the length of the body and there was both lung and liver damage. It took three days' chasing, mostly on elephant back, to come up with it, when it was killed through a heart shot.

The following case dealing with the shape of a tiger's head, and head shots, may not be irrelevant. The tiger has no forehead, and in this respect is quite different from the domestic cat. With the domestic animal mentioned there is a definite forehead which drops from the top of the skull. This forehead makes an angle with the nasal bones, an angle which may best be described with a little license, as a concave angle. However, in the case of the tiger the top of the skull comes straight on to the nasal bones without any deactivation. Running from the top of the nasal bones up between the eyes towards the top of the skull is a pad of muscle which bulges out in a marked manner. This bulge causes the lines of the animal's head to show, from the side, a marked angle made by the top of the skull and the line made by the pad of muscle which runs down to the nasal bones. The angle made by these lines may with again a little license be described as a convex angle. Thus, when looking at that part of a tiger's face in line with the eyes we find from the side a convexity and not a concavity as is the case in the domestic cat. This peculiarity of shape must be borne in mind when taking a head shot. A shot between the eyes can be deflected by the pad of muscle which is there, and the bullet can go round through it to over the top of the skull, where there is more flesh than is generally imagined. At best only temporary unconsciousness ensues with such a wound.

Maharaj Vir Bhadar Singh, when Commissioner of Bilaspur, met by chance, while driving over a jungle road, a good sized tiger. He jumped out of his car and took a head shot between the eyes with, I believe, a 0.475 no. 2 rifle. The tiger dropped in its tracks, and the other occupants of the car jumped out to pick up the trophy and put it in the car. Fortunately the Maharaj Saheb, an old hand at tiger hunting, believed in always putting in a second shot, no matter

how dead the animal may appear to be. His second shot, into the shoulder of an apparently very dead tiger, was greeted by the animal jumping high into the air. Only temporary unconsciousness had taken place, and the second and very necessary shot ended life of the tiger. When I heard of this story, I immediately formed the opinion that the first bullet had been deflected by the muscle pad between the eyes. I had the opportunity of asking Maharaj Vir Bhadar Singh about this, and he confirmed what I had guessed was right. Much the same thing with a head shot happened to Dunbar-Brander, author of "The Wild Animals of Central India", and he was nearly killed as a result of assuming that a tiger bleeding in the head from a 0.577 bullet wound was dead.

Considering that many sportsmen insist in using quite unsuitable rifles on tiger, the following story may have a moral in it somewhere. Lt. Gen. Sir Phillip Neame, V.C., shot a tigress through the heart with a 0.375/0.300 but did not kill her at once. As the light was fading rapidly and his men were coming up, he followed up immediately, changing over a 0.450/0.400. He was charged at close quarters and his shot failed to stop the animal which mauled him before dying on him. Sir Phillip recovered from the mauling. He thereafter shot his tigers with a 0.577.

There is no doubt that any modern small or medium bore rifle, magnum or otherwise, will kill a tiger if the bullet is correctly placed. But such a rifle cannot be expected to compare with a 0.470 class rifle so far as flooring the animal is concerned. Whatever rifle one uses, accuracy is all important. However, perfectly accurate shooting can be made with heavy rifles of the .470 class. Therefore, it is only logical, in view of the tremendous vitality shown by tigers at times, to use really powerful weapons under conditions where unarmed beaters have to be protected. In a beat, merely killing a tiger is not enough; the objective must be, as far as is possible, to floor the animal. Therefore, a heavy rifle is indicated. I fail to see why unarmed beaters should be endangered more than necessary just because some 'sportsman wishes to brag later about the tiger he killed with one shot from his little rifle.

If one is stalking one's quarry by oneself, one is certainly entitled to use a small or-medium bore rifle. Such a rifle will kill with certainty if the bullet is properly placed. That it may or may not drop dead the animal, and thus cause danger to oneself; is a matter entirely for the sportsman himself to consider. It concerns no one else. Similarly, if one is sitting up for tiger, by all means use a small or medium bore. If your bullet is properly placed, which it should be no matter that you are using a small, medium, heavy medium or large bore rifle,

then your tiger will certainly be killed. Here, there is no absolute necessity for dropping the animal in its tracks. But if one is shooting in a beat, it is only sportsmanlike to protect your men by shooting carefully and using a really powerful weapon, which naturally has a better chance of knocking down your quarry than a lighter rifle.

Most heavy rifles are made as doubles. Theoretically a double can never be as accurate as a single. However, as Burrard says in his "Notes on Sporting Rifles":—

"The ranges at which shots can normally be taken in dense jungle are not sufficiently long to cause the slight potential wider grouping capacity of a double barrel rifle, when compared with a single to make any practical difference whatever."

Any good, large bore double barrel rifle should put both barrels into a 3 inch group at 100 yards, which is a long shot at tiger. It should be borne in mind that large bore cordite rifles have as flat a trajectory as needed for tiger shooting. A rifle of the 0.470 class may be sighted at 150 yards when at no point will the bullet rise above the line of sight by more than 2.2 inches. So sighted, the bullet drop at 175 yards will be but 2.5 inches, so the rifle may be treated as shooting point blank up to 175 yards. And half that range would be a long shot at a tiger indeed. There is no reason to fight shy of a large bore rifle for tiger on the grounds of accuracy.

There is at present a school of thought which holds that a super high velocity light bullet will paralyze an animal by virtue itself. Now I have seen two leopards' heart shot with the 0.300 Weatherby magnum, which give 4000 ft. lb. muzzle energy at 4000, ft./secs. Muzzle velocity with the 150 grains bullet, go 40 yards and 150 before dropping. I can only conclude that such weapons are not suitable for tiger, though they may be the answer for long range shooting in the open at other game. For tiger there can be no doubt that a minimum bullet weight of 480 grains is required if the rifle is to be used in all the hunting conditions possible.

The improper selection of rifle gives the tiger ample opportunity to take a second lease of life after being shot at by medium rifles. Any shot proclaimed to be on the forehead of the tiger is a misnomer. Tigers can survive, though for short durations, the bullet injuries of medium rifles; hence, it is advised that heavy rifles up to 150-175 yard range can be presumed to be fatal to the beast. One should never leave an injured animal in the forest for the sake of other inmates and humans. It can be said that similar to the cat, its feline member tiger may have a chance of nine lives that is to say, it can survive small shots.

Pathogenecity Studies on the Population of Migratory Nematode *Pratylenchus penetrans* (Cobb, 1917) (Nematode: Hoplolamidae) on Tea Plantations in Doon Valley

Madan Lal

Abstract

While studying pathogenicity of *P. penetrans*, it was found that by inoculation of population of 10 or 100 *P. penetrans* per pot, the weight of fresh shoots and roots of tea plants in sandy-loam soil after three months did not differ significantly as compared to control tea plants. In both the soils, reduction in weight of fresh shoot was significant when 1000 nematodes were inoculated and was highly significant when 2000 nematodes were inoculated. In sandy-clay soil, the reduction in the dry root weight was insignificant when 100 nematodes were inoculated per pot as compared with untreated tea plants, but with the 100, 1000 and 2000 nematodes, the reduction in the weight of dry shoots was significant. Inoculation of 10, 100 and 1000 nematodes per pot containing sandy-loam soil did not caused many effects on the growth of tea plants up to two months but the growth was significantly affected during the third months as compared to plants without any inoculation.

Keywords: Pathogenecity, *P. penetrans*, Nematode, Tea plantation

Introduction:

Nematodes are microscopic eel-like organisms that live in soil and water. They are most abundant multicellular organisms on earth. Most soil dwelling nematodes are beneficial organisms that play a role in the break down and release of nutrients from organic matter. Some beneficial nematodes prey on other nematodes as well as soil-borne insect, fungal and bacteria pests. Unfortunately, there are several species of nematodes that feed on or in roots, stems or bulbs resulting in significant yield reduction in both field and horticulture crops.

As a little work has been carried out on nematode pests of tea plantations from Doon Valley. Furthermore, no comprehensive information exists on Pathogenecity Studies on the Population of Migratory Nematode *Pratylenchus penetrans* (Cobb 1917), which cause heavy loss to tea plants, and thereby the quality of tea is deteriorated. It is the need of the hour also to update latest information on the nematode pests associated with tea plants in district Dehradun. Also, there are almost no studies on histopathological changes as a result of heavy infection of phytonematodes.

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Materials and Methods

Three thermostatically controlled temperature tanks as described by Sivpalan (1972) and Gnanapragasam (1987) were used to maintain a steady temperature of the soil contained in 15 cm wide cement pots (12, 18, 24°C respectively). Each pot was filled with 1,250 cc of nursery soil, mixed in the proportion of 3 parts gravel and one part clay and pre-treated to soil fumigation with methyl bromide at the rate of 0.5 kg/2.83 m³. Twelve month old plants of nematode susceptible clone - TRL 2024 of uniform size were transplanted into these pots and maintained in the green house for a period of 2 weeks prior to transferring them to the respective temperature tanks. A set of 18 pots were transferred into each constant temperature tank. In each tank the sub treatments were inoculation of suspensions of nematodes to each plant. The inoculation was done at the end of 5 months after transferring the pots to the tanks as follows: Group of three pots/tank were inoculated with one of the following levels - 0, 50, 500, 1000 and 5000 nematodes per plant. The inoculated group of three pots serving as control to estimate the degree of pathogenecity.

The different treatments in the respective soil temperature were arranged in a completely randomised block design. The treated plants were removed for assessments. Fresh shoot and root weights were determined and the nematodes were recovered from the roots by the modified Baerman Funnel technique, as described by Hutchinson (1962).

Observations

The damage to the tea and nursery plants by the nematode *P. penetrans* in terms of reduction in the weight of fresh and dry shoots and roots and retardation of growth is shown in tables. It was found that by inoculation of population of 10 or 100 *P. penetrans* per pot, the weight of fresh shoots and roots of tea plants in sandy-loam soil after three months did not differ significantly as compared to control tea plants [Table 1(A) & 1(B); Fig. 1 & 2]. In both the soils, reduction in weight of fresh shoot was significant when 1000 nematodes were inoculated and was highly significant when 2000 nematodes were inoculated. In sandy-clay soil, reduction in the weight of fresh roots by inoculation of 10 *P. penetrans* was only in significant as compared to the control group of tea plants, while reduction in weight of fresh shoot was significant at 10, 100 and 1000 number of *P. penetrans* and highly significant at 200 nematodes per pot [Table 2(A) & 2(B)]. In sandy

loam soil, inoculation of 10, 100 and 1000 nematodes per pot, the reduction in the weight of dry root was insignificant as compared to the control group of tea plants, but with 2000 numbers of the nematodes per pot the reduction in the weight was significant [Table 3(A)]. The reduction in the weight of dry shoots by inoculating 10 numbers of nematodes per pot containing sandy-loam soil was insignificant, whereas the reduction in the weight was significant when 100 nematodes were inoculated and was highly significant if more numbers of the nematodes (1000 & 2000) were inoculated [Table 3(B)].

In sandy-clay soil, the reduction in the dry root weight was insignificant when 100 nematodes were inoculated per pot as compared with untreated tea plants, but with the 100, 1000 and 2000 nematodes, the reduction in the weight of dry shoots was significant (Table 4(A)), while the reduction in the weight of dry shoots was significant with various numbers of the nematodes (10, 100, 1000 and 2000) inoculated per pot [Table 4(B)].

Further, it was found that inoculation of 10, 100 and 1000 nematodes per pot containing sandy-loam soil caused not much effect on the growth (e.g. plant length) of tea plants upto two months but the growth was significantly affected during the third month as compared to plants without any inoculation [Table 5(A); Fig. 3]. In addition, tea plants inoculated with 2000 numbers of nematodes, showed not only marked reduction in their growth but also wilting leaves; and as a result the plants were died.

In sandy-clay soil, it was found that by inoculation of various tested numbers of nematodes per pot, there was no effect on the growth of tea plants during 10, 100, 1000 and 2000 per pot. There was pronounced effect on the growth of tea plants after 75, 48, 30 and 19 days respectively and was highly significant in latter after three months [Table 5(B); Fig. 3]. Thus the observations made on the tea nursery plants, both in sandy-clay and sandy-loam soils revealed that the reduction in the weight of the shoots and roots were inversely proportional to the number of nematodes inoculated.

Discussion

The damage to the tea nursery plants by the nematode *P. penetrans* in terms of reduction in the weight of fresh and dry shoots and roots and retardation of growth showed significant results. In both the soils, reduction in weight of fresh shoot was significant when 1000 nematodes were inoculated and was highly significant when 2000 nematodes were inoculated.

However, in sandy-clay soil, the reduction in the dry root weight was insignificant when 100 nematodes were inoculated per pot as compared with untreated tea plants; but with the 100, 1000 and 2000 nematodes, the reduction in the weight of dry shoots was significant.

On the factors that affects the field establishment of young tea is the initial population level (PI) of plant pathogenic nematodes. It was also recorded that inoculation of 10, 100 and 1000 nematodes per pot containing sandy-loam soil caused not much effect on the growth (e.g. Plant length) of tea plants up to two months but the growth was significantly affected during the third months as compared to plants without any inoculation.

While comparing the results of the present study with those of earlier workers (Oostenbrink 1966; Olthof and Poller 1972; Gnanapragasam 1984; Gnanapragasam, 1987; Gnanapragasam *et al.* 1989; Amarsinghe and Hominick, 1993), it is gathered that none of the authors have carried out studies separately in sandy-clay and sandy-loam soil. Moreover, in the present study the observations reveal an inversely proportional relationship between the number of nematodes inoculated and the reduction in the weight of the shoots and roots of tea plantations.

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Table - 1(A): Showing fresh shoot weight of tea plants in sandy-loam after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	62.40	58.50	60.00	50.60	28.80	260.30
R ₂	60.40	63.25	60.50	55.00	29.00	268.15
R ₃	58.00	60.00	58.70	50.40	32.00	259.10
R ₄	58.00	59.00	57.00	50.10	30.00	254.10
R ₅	63.40	58.00	62.00	54.50	30.00	267.90
Total	302.20	298.75	298.20	260.60		1309.55

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	29.26	7.4	2.09	> 1
Inoculum	4	3373.56	843.39	238.24	> 3.18
Error	16	56.78	3.54		
Total	24	3459.61			

C.D. at 5% = 2.61

C.D. at 1% = 3.44

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	60.44
10	59.75
10^2	59.64
10^3	52.12
2×10^3	29.96

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.89
0 and 10^2	0.80
0 and 10^3	8.32
0 and 2×10^3	30.48
10 and 10^2	0.11
10 and 10^3	7.63
10 and 2×10^3	29.79
10^2 and 10^3	7.52
10^2 and 2×10^3	29.68
10^3 and 2×10^3	22.16

* Significant at 5%

Table - 1(B): Showing fresh root weight of tea plants in sandy-loam after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10 ²	10 ³	2 x 10 ³	
R ₁	13.50	11.22	11.00	9.08	3.04	47.84
R ₂	11.88	12.04	11.36	8.26	2.45	45.95
R ₃	13.00	12.38	10.88	8.87	2.74	47.87
R ₄	11.34	10.66	11.31	7.74	2.48	43.53
R ₅	10.80	11.88	10.12	9.42	5.12	47.34
Total	60.52	58.18	54.67	43.37	15.83	232.53

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	2.70	0.67	0.90	< 1
Inoculum	4	270.78	67.69	91.47	> 3.18
Error	16	11.97	0.74		
Total	24	285.46			

C.D. at 5% = 1.15

C.D. at 1% = 1.57

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	12.10
10	11.63
10 ²	10.93
10 ³	08.67
2 x 10 ³	03.16

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.47
0 and 10 ²	1.17
0 and 10 ³	3.43
0 and 2 x 10 ³	8.94
10 and 10 ²	0.70
10 and 10 ³	2.96
10 and 2 x 10 ³	8.47
10 ² and 10 ³	2.26
10 ² and 2 x 10 ³	7.77
10 ³ and 2 x 10 ³	5.51

* Significant at 5%

Table - 2(A): Showing fresh shoot weight of tea plants in sandy-clay after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	75.00	72.04	60.30	37.52	12.43	257.25
R ₂	76.39	69.92	59.06	38.93	15.09	259.35
R ₃	73.00	69.88	58.03	39.04	12.92	252.87
R ₄	75.72	71.64	61.00	38.24	14.52	261.12
R ₅	76.88	71.50	60.84	40.04	13.07	262.33
Total	376.99	354.98	299.23	193.77	68.03	1292.92

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	11.09	2.77	2.56	> 1
Inoculum	4	13103.46	3275.86	3033.20	> 3.18
Error	16	17.34	1.08		
Total	24	13131.90			

C.D. at 5% = 1.39

C.D. at 1% = 1.89

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	75.39
10	70.99
10^2	59.84
10^3	38.75
2×10^3	13.60

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	4.40
0 and 10^2	15.55
0 and 10^3	36.64
0 and 2×10^3	61.79
10 and 10^2	11.15
10 and 10^3	32.24
10 and 2×10^3	57.39
10^2 and 10^3	21.09
10^2 and 2×10^3	46.24
10^3 and 2×10^3	25.15

* Significant at 5%

Table - 2(B): Showing fresh root weight of tea plants in sandy-clay after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10 ²	10 ³	2 x 10 ³	
R ₁	17.67	17.52	16.72	10.86	1.59	64.36
R ₂	19.36	17.00	15.23	11.20	1.97	64.76
R ₃	18.16	18.47	18.69	9.54	1.26	66.12
R ₄	19.90	18.82	17.06	10.23	1.30	67.31
R ₅	19.08	16.39	16.15	11.19	1.66	64.47
Total	93.17	88.20	83.85	53.02	7.78	327.02

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	1.30	0.32	0.09	< 1
Inoculum	4	994.78	248.69	76.05	> 3.18
Error	16	52.32	3.27		
Total	24	1048.41			

C.D. at 5% = 2.42

C.D. at 1% = 3.32

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	18.63
10	17.64
10 ²	16.77
10 ³	10.60
2 x 10 ³	01.55

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.99
0 and 10 ²	1.86
0 and 10 ³	8.03
0 and 2 x 10 ³	17.08
10 and 10 ²	0.87
10 and 10 ³	7.04
10 and 2 x 10 ³	16.09
10 ² and 10 ³	6.17
10 ² and 2 x 10 ³	15.22
10 ³ and 2 x 10 ³	9.05

* Significant at 5%

Table - 3(A): Showing dry shoot weight of tea plants in sandy-loam after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	7.36	5.87	7.28	3.68	1.75	25.94
R ₂	7.27	7.39	4.88	5.26	1.35	26.15
R ₃	6.35	6.53	6.00	3.35	1.65	23.88
R ₄	8.00	7.00	5.49	4.28	1.58	26.35
R ₅	7.19	5.20	6.00	2.78	1.63	22.80
Total	36.17	31.99	29.65	193.5	7.96	125.12

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	2.02	0.50	0.87	< 1
Inoculum	4	103.50	20.70	36.31	> 3.18
Error	16	9.16	0.57		
Total	24	114.69			

C.D. at 5% = 1.0%

C.D. at 1% = 1.37

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	7.23
10	6.39
10^2	5.93
10^3	3.87
2×10^3	1.59

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.84
0 and 10^2	1.30
0 and 10^3	3.36
0 and 2×10^3	5.64
10 and 10^2	0.46
10 and 10^3	2.52
10 and 2×10^3	4.80
10^2 and 10^3	2.06
10^2 and 2×10^3	4.34
10^3 and 2×10^3	2.28

* Significant at 5%

Table - 3(B): Showing dry root weight of tea plants in sandy-loam after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	3.30	2.39	2.17	2.13	0.98	10.97
R ₂	2.40	2.24	2.27	1.98	0.21	9.10
R ₃	3.16	3.56	1.97	2.77	0.35	11.01
R ₄	2.32	2.36	2.08	2.00	0.75	9.51
R ₅	1.80	1.34	2.37	1.98	0.72	8.21
Total	12.98	11.89	10.86	10.86	3.01	49.60

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	1.69	0.42	3	< 1
Inoculum	4	12.55	3.06	21.85	> 3.18
Error	16	22.34	0.14		
Total	24	16.59			

C.D. at 5% = 0.50

C.D. at 1% = 0.67

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	2.59
10	2.37
10^2	2.17
10^3	2.17
2×10^3	0.60

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.22
0 and 10^2	0.42
0 and 10^3	0.42
0 and 2×10^3	1.99
10 and 10^2	0.20
10 and 10^3	0.20
10 and 2×10^3	1.77
10^2 and 10^3	0.00
10^2 and 2×10^3	1.57
10^3 and 2×10^3	1.57

* Significant at 5%

Table - 4(A): Showing dry shoot weight of tea plants in sandy-clay after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10 ²	10 ³	2 x 10 ³	
R ₁	13.21	12.10	10.98	5.65	2.51	44.45
R ₂	15.12	11.22	11.02	5.45	1.87	44.68
R ₃	13.83	09.93	10.14	6.62	1.48	42.00
R ₄	12.72	10.25	9.22	6.13	2.08	40.40
R ₅	12.87	12.67	10.04	8.06	2.33	45.97
Total	67.75	56.17	51.40	31.91	10.27	217.50

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	4.05	1.01	1.31	< 1
Inoculum	4	409.90	102.47	133.07	> 3.18
Error	16	12.36	0.77		
Total	24	426.31			

C.D. at 5% = 1.17

C.D. at 1% = 1.60

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	13.55
10	11.23
10 ²	10.28
10 ³	06.38
2 x 10 ³	02.05

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	2.32
0 and 10 ²	3.27
0 and 10 ³	7.17
0 and 2 x 10 ³	11.50
10 and 10 ²	0.95
10 and 10 ³	4.85
10 and 2 x 10 ³	9.18
10 ² and 10 ³	3.90
10 ² and 2 x 10 ³	8.23
10 ³ and 2 x 10 ³	4.33

* Significant at 5%

Table - 4(B): Showing dry root weight of tea plants in sandy-clay after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	4.80	4.03	4.11	1.84	0.57	15.35
R ₂	5.10	5.25	4.16	2.31	0.36	17.18
R ₃	4.20	4.60	4.17	3.00	0.62	16.59
R ₄	3.87	3.68	3.91	1.75	0.50	13.71
R ₅	5.10	4.17	3.37	1.36	0.69	14.69
Total	23.07	21.73	19.72	10.26	2.74	77.52

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	1.57	0.39	1.95	>1
Inoculum	4	60.83	15.20	7.6	> 3.18
Error	16	3.23	0.20		
Total	24	65.64			

C.D. at 5% = 0.59

C.D. at 1% = 0.81

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	4.61
10	4.34
10^2	3.94
10^3	2.05
2×10^3	0.54

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	0.27
0 and 10^2	0.67
0 and 10^3	2.56
0 and 2×10^3	4.07
10 and 10^2	0.40
10 and 10^3	2.29
10 and 2×10^3	3.80
10^2 and 10^3	1.85
10^2 and 2×10^3	3.40
10^3 and 2×10^3	1.51

* Significant at 5%

Table - 5(A): Showing shoot length of tea plants in sandy-loam after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	22.23	20.90	18.40	15.40	7.40	84.33
R ₂	22.13	21.30	18.00	14.00	5.20	80.63
R ₃	22.09	20.20	19.10	15.20	6.70	83.25
R ₄	22.26	19.60	16.60	14.80	8.60	81.86
R ₅	23.29	21.10	19.20	16.10	5.90	85.59
Total	112.00	103.10	91.30	75.50	33.80	415.66

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	3.07	0.76	0.89	< 1
Inoculum	4	759.47	189.86	223.36	> 3.18
Error	16	13.70	0.85		
Total	24	776.25			

C.D. at 5% = 1.23

C.D. at 1% = 1.69

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	22.40
10	20.26
10^2	18.26
10^3	15.10
2×10^3	6.76

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	1.78
0 and 10^2	4.14
0 and 10^3	7.30
0 and 2×10^3	15.64
10 and 10^2	2.36
10 and 10^3	5.52
10 and 2×10^3	13.86
10^2 and 10^3	3.16
10^2 and 2×10^3	11.50
10^3 and 2×10^3	8.34

* Significant at 5%

Table - 5(B): Showing shoot length of tea plants in sandy-clay after inoculation of the nematode *P. penetrans*

Replications	No. of <i>P. penetrans</i> inoculated					Total
	0	10	10^2	10^3	2×10^3	
R ₁	26.00	21.20	15.80	13.10	5.40	81.50
R ₂	25.50	21.50	14.10	11.30	4.60	77.00
R ₃	25.20	22.00	16.50	13.70	5.00	82.40
R ₄	24.60	20.40	14.30	12.70	5.70	77.70
R ₅	26.10	22.10	15.40	12.10	6.10	81.80
Total	127.40	107.20	76.10	62.90	26.80	400.40

ANOVA

Source of variations	d.f.	S.S.	M.S.S.	F.Cal.	F.Tab.
Replications	4	5.10	1.27	2.88	>1
Inoculum	4	1224.85	306.21	695.93	> 3.18
Error	16	7.15	0.44		
Total	24	1237.18			

C.D. at 5% = 0.88

C.D. at 1% = 1.19

Mean Difference Table

No. of <i>P. penetrans</i> inoculated	Mean Weight
0	25.48
10	21.44
10^2	15.22
10^3	12.58
2×10^3	5.36

Difference between means of No. of *P. penetrans* inoculated

No. of <i>P. penetrans</i> inoculated	Mean difference from Control
0 and 10	4.04
0 and 10^2	10.26
0 and 10^3	12.90
0 and 2×10^3	20.12
10 and 10^2	6.22
10 and 10^3	8.86
10 and 2×10^3	16.08
10^2 and 10^3	2.64
10^2 and 2×10^3	9.86
10^3 and 2×10^3	7.22

* Significant at 5%

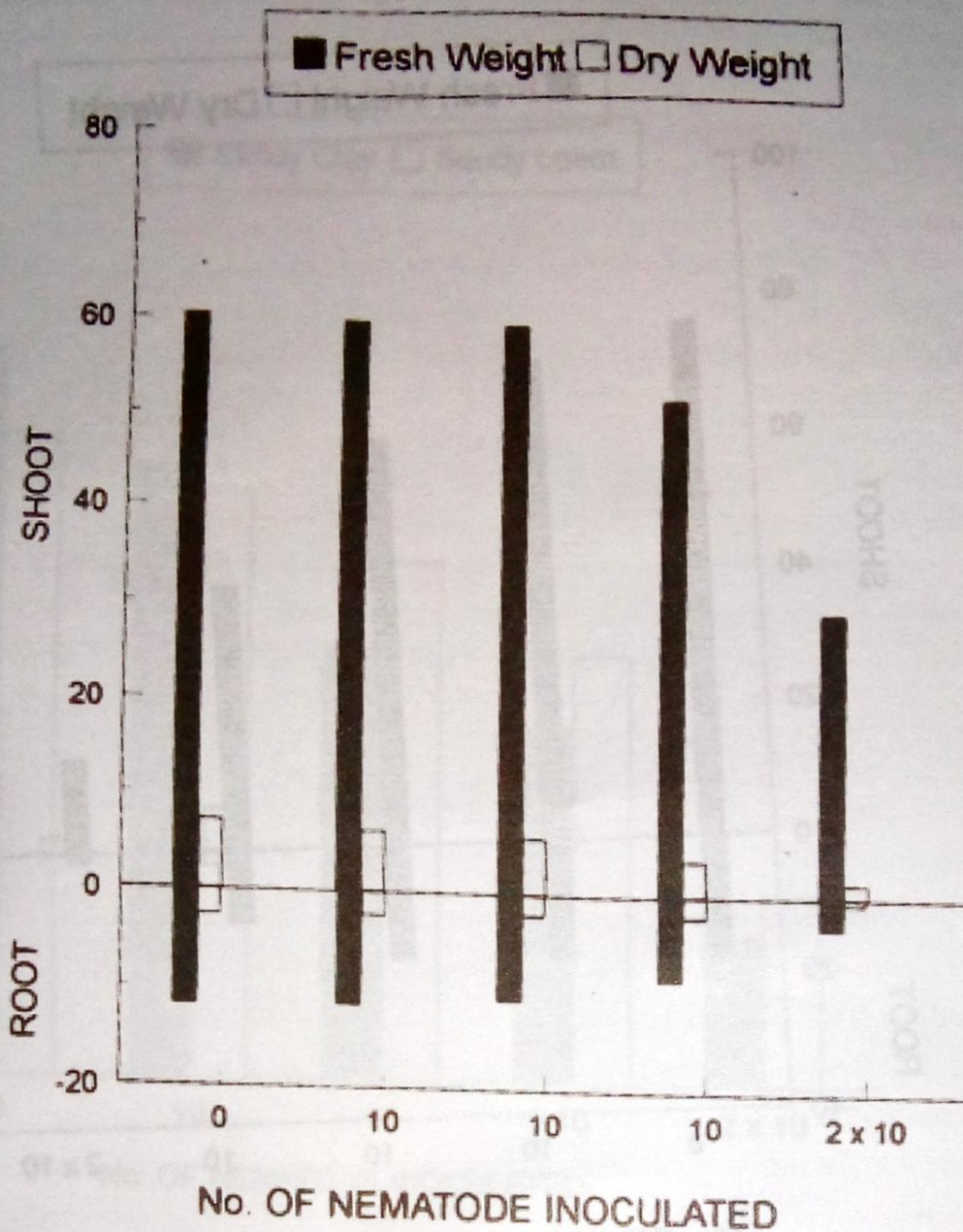


Fig. 1: Effect of Pathogenecity on Tea Plant at (25° C) to *P. penetrans* Population in Sandy Loam Soil

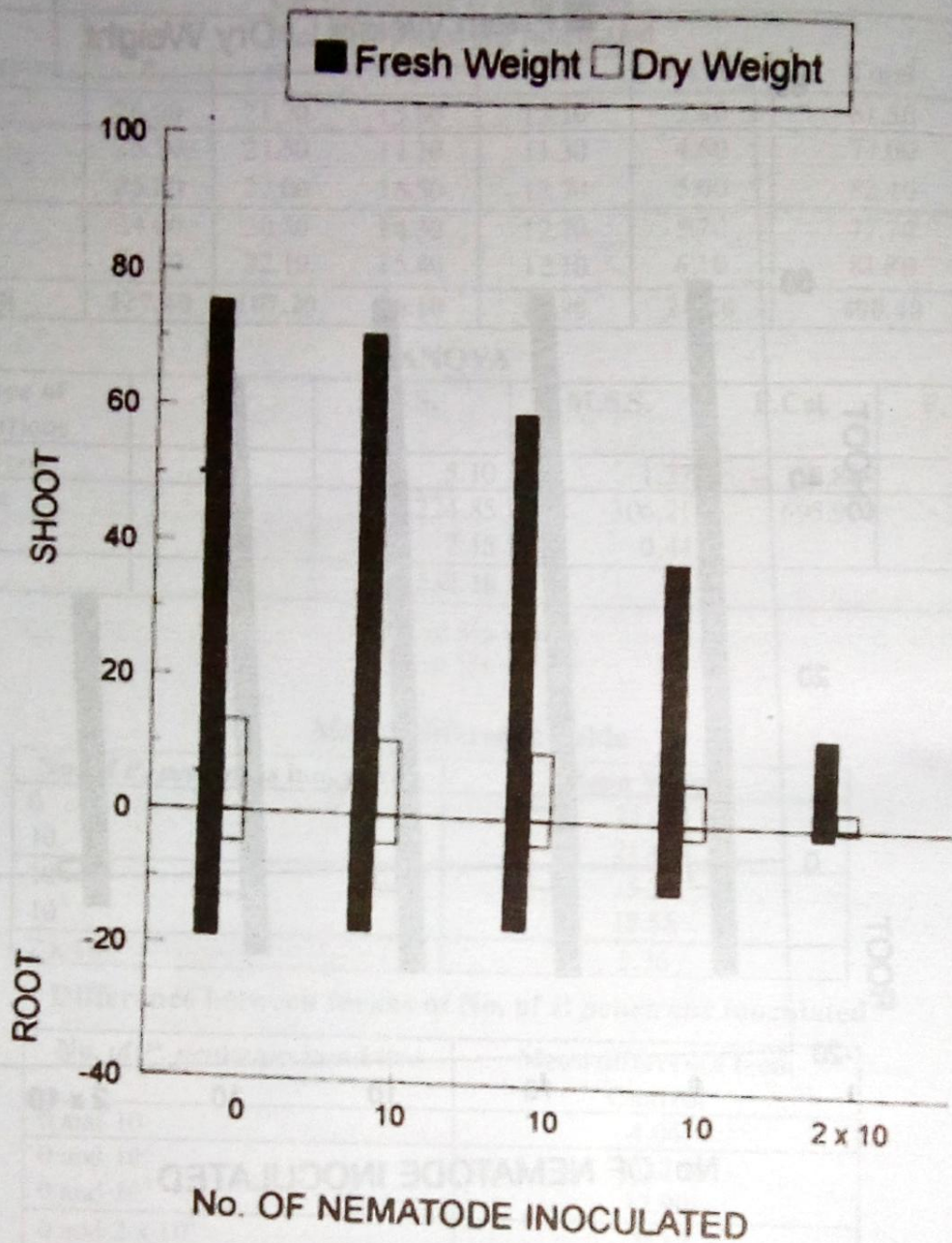


Fig. 2: Effect of Pathogenicity on Tea Plant at (25° C) to *P. penetrans* Population in Sandy Clay Soil

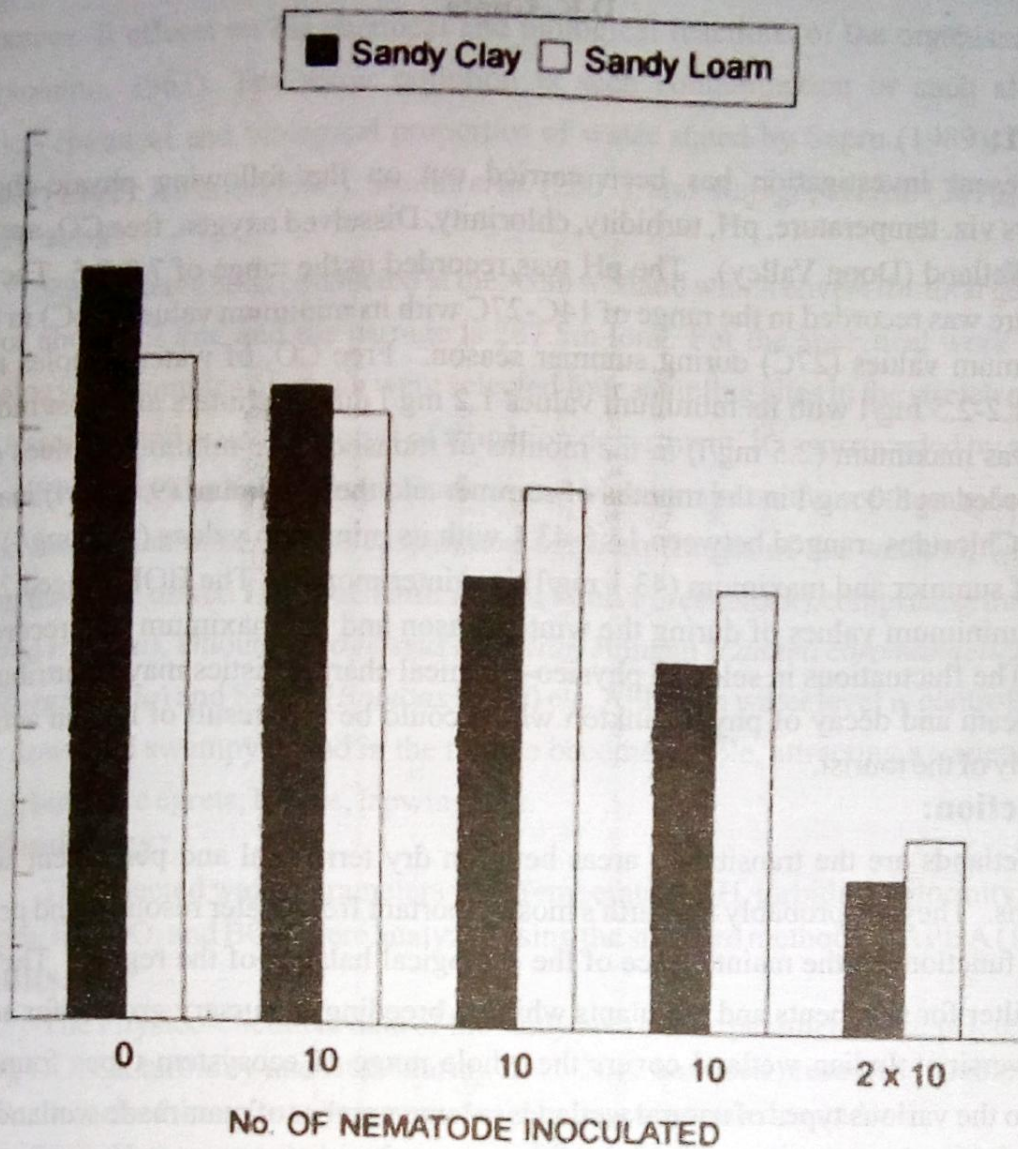


Fig. 3: Showing Nematode Population in relation to Plant Growth (Shoot Length)

A study on physico-chemical parameters of Asan Wetland, Dehradun (Uttarakhand)

D.K. Gupta

Abstract:

Present investigation has been carried out on the following physico-chemical parameters viz. temperature, pH, turbidity, chlorinity, Dissolved oxygen, free CO₂ and BOD of Asan Wetland (Doon Valley). The pH was recorded in the range of 7.0-8.5. The water temperature was recorded in the range of 14°C-27°C with its minimum values (14°C) in winter and maximum values (27°C) during summer season. Free CO₂ of water samples ranged between 1.2-2.5 mg/l with its minimum values 1.2 mg/l during winters and post monsoon while it was maximum (2.5 mg/l) in the months of monsoon. The minimum values of DO were recorded as 8.0 mg/l in the months of summer and the maximum (9.8 mg/l) in winter months. Chlorides ranged between 13.5-43.1 with its minimum values (13.5 mg/l) in the months of summer and maximum (43.1 mg/l) in winter months. The BOD ranged 2.2-4.6 mg/l, the minimum values of during the winter season and the maximum was recorded in summer. The fluctuations in selected physico-chemical characteristics may be attributed to growth, death and decay of phytoplankton which could be as a result of human activities particularly of the tourist.

Introduction:

Wetlands are the transitional areas between dry terrestrial and permanent aquatic ecosystems. They are probably the earth's most important fresh water resource and perform manifold functions in the maintenance of the ecological balance of the region. They also work as filter for sediments and pollutants while as breeding or nursery ground for aquatic faunal diversity. Indian wetland covers the whole range of ecosystem types found. In addition to the various types of natural wetlands, a large number of man-made wetlands also contribute to the faunal and floral diversity. Country's land area under man-made wetland is increasing primarily due to various irrigation and hydro-electric activities.

Physico-Chemical analysis is the prime consideration to assess the quality of water for its best utilization like drinking, fishing, industrial and irrigation purpose etc. and to know the pollution strength and its effect on ecology. The fluctuations in various physico-chemical characteristics may be attributed to, growth, death and decay of phytoplankton in these ponds (Welch, 1951). The unity of the organism and its environment is a basic principle of ecology. The organism cannot exist without the environment of only organism, population or species

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lives at the expense of its environment, without this interaction it ceases to exist (Nikolsky, 1963). The temperature of water controls the chemical reactions, the solubility of substances. It effects on the chemical and biological reactions of the organisms in water. (Sacramento, 1963). The water pollution is such contamination or such alteration of Physico-chemical and biological properties of water stated by Sapru (1989); Ghatak and Kormar (1992); Khanna (1993); Smitha *et al.* (2007); and Rajagopal *et al.* (2010)

Study area:

Studies have been conducted at the Asan wetland which covers the total geographical area of about 3.2 km² and the barrage is 287.5m long. For the analytical work of wetland hydrology, the samples of which were selected four sampling sites in the stretch of about 4.0 km². Asan wetland is under control of irrigation department. It is surrounded by agricultural fields of villages like Kunja grant, Dudhali and Matakmaajri on the southern side. There is a mixed forest plantation on the eastern and northern fringes of the wetland, while further south, there are mixed forest of Timli range (Timli Forest block), comprising mainly of Sal (*Shorea robusta*), Dhouri (*Anogeissus latifolia*), Jhingan (*Lannea coromandelica*) Shisham (*Dulbergia sisoo*) and Semal (*Bombax ceiba*) etc. Although water level is controlled, it often goes down and swampy island in the middle become visible, attracting a variety of marsh-loving birds like egrets, herons, lapwings etc.

Methodology:

The selected water parameters viz., Temperature, pH, turbidity, chlorinity, Dissolved oxygen, free CO₂ and BOD were analyzed using the standard methods of APHA (1998).

Results:

The Physico-chemical data of the study area on the parameters viz. pH, temperature, FCO₂, DO, Cl, turbidity and BOD during 2011-2012 has been presented in table 1 & 2. The details on each of the selected parameters are being enumerated as under-

pH: The pH was recorded in the range of 7.0-8.5 with minimum value in the month of October (post monsoon) and maximum in the month of July (Monsoon) (table 1), Season-wise data on pH values (Mean $\pm$ SD) of water at Asan Wetland has been presented in table 2 and fig. 1.

Temperature: The water temperature was recorded in the range of 14C-27C with its minimum values (14C) in winter and maximum values (27C) during summer season. Season-wise data on Temperature (C) (Mean $\pm$ SD) of water at Asan Wetland during study period is shown in table 2 and fig. 1.

FCO₂ (mg/l): Free CO₂ of water samples ranged between 1.2-2.5 mg/l with its minimum values 1.2 mg/l during winters and post monsoon while it was maximum (2.5 mg/l)

in the months of monsoon (table-2). Season-wise data on FCO_2 (mg/l) values (Mean $\pm$ SD) of water at Asan Wetland during the study period is presented in table 2 and fig.1.

DO (mg/l): The minimum values of DO were recorded as 8.0 mg/l in the months of summer and the maximum (9.8 mg/l) in winter months. Season-wise data on DO (mg/l) (Mean $\pm$ SD) of water at Asan Wetland during the period of study is presented in table 2 and fig.1.

Chlorides: the value of chlorides was ranged between 13.5-43.1 with its minimum values (13.5 mg/l) in the months of summer and maximum (43.1 mg/l) in winter months (table-2). Season-wise data on Cl (mg/l) concentration (Mean $\pm$ SD) in water samples at Asan Wetland during the year 2011-12 is mentioned in table 2 and fig.1.

Turbidity: The maximum value was 3.9 NTU in the month of July. Season-wise data on Turbidity (NTU) (Mean $\pm$ SD) of water at Asan Wetland during the study period is shown in fig.1.

BOD: The BOD ranged 2.2-4.6 mg/l, the minimum values of during the winter season and the maximum was recorded in summer. Season-wise data on BOD (mg/l) (Mean $\pm$ SD) of water samples at selected sites in Asan Wetland during the year 2011-12 is presented in table 2 and fig.1.

Discussion:

The physico-chemical analysis has a great bearing in the elucidation of any aquatic ecosystem and is essential to bring out various aspects of pollution and also for the complete understanding of the biological phenomenon.

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Table:1 Showing values of selected parameters (Temperature, pH, turbidity, chlorinity, Dissolved oxygen, free CO₂, and BOD) of water samples at Asan Wetland during May 2011 – April 2012

Months	Temp.	pH	DO	FCO ₂	Chlorinity	Turbidity	BOD
May	24	8.0	8.0	1.9	13.5	1.9	4.3
June	27	8.0	8.3	2.2	19.6	2.7	4.6
July	26	8.5	8.5	2.5	22.8	3.9	4.5
August	26	8.0	8.7	1.2	20.6	3.5	4.2
Sept.	22	7.5	8.5	1.2	16.2	3.6	4.1
Oct.	22	7.0	8.2	1.8	23.0	1.3	4.5
Nov.	18	7.5	8.9	1.2	34.2	1.0	3.8
Dec.	16	7.3	9.5	1.2	42.0	1.0	2.2
Jan.	14	7.5	9.8	1.5	43.1	0.0	2.9
Feb.	14	7.5	9.5	1.8	42.6	0.0	3.2
March	20	7.8	9.3	1.2	35.1	1.8	3.1
April	20	8.2	8.9	1.5	15.8	2.1	3.9

Table: 2 Seasonwise values of selected parameters of water samples at Asan Wetland during the study period (May 2011 – April 2012)

Parameters	Winter	Summer	Monsoon	Post Monsoon
Temperature	14.6±1.15	22.7±3.40	26.0±0	20.6±2.30
pH	7.4±0.11	8.0±0.16	8.25±0.35	7.3±0.28
Turbidity	8.33±0.57	2.12±0.40	3.7±0.28	1.96±1.42
Chlorinity	42.5±0.55	21.0±9.73	21.7±1.55	24.4±9.08
Dissolved oxygen	9.6±0.17	8.6±0.58	8.6±0.14	8.5±0.35
free CO ₂	1.5±0.3	1.7±0.43	1.8±0.91	1.41±0.34
BOD	2.7±0.51	3.9±0.65	4.3±0.21	4.1±0.35

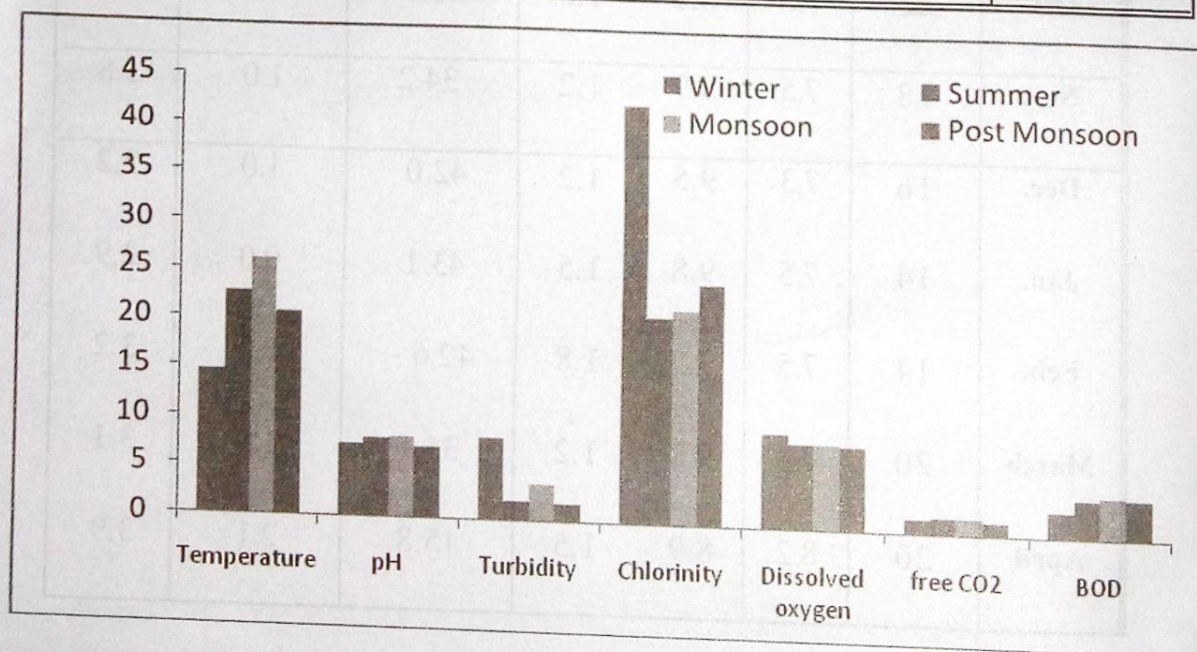


Fig. 1 : Seasonwise Graph of selected parameters of water samples at Asan Wetland during the study period

The temperature of water controls the chemical reactions, the solubility of substances. It effects on the chemical and biological reactions of the organisms in water. The growth of nuisance of organism is enhanced by warm water condition and could lead to the development of unpleasant taste and odours (Sacramento, 1963). The highest range of temperature was recorded as 27°C during summer. While the lowest temperature was recorded as 14°C from Asan wetland. Michael (1984) stated that organism can function comfortably over long period of time at a temperature range of 20-28.5°C. The present study observed that there was not much variation in the temperature of water at all the four sites of Asan wetland. WHO (World Health Organisation (1984) did not recommended any definite values of temperature. Kiran *et al.* (2007) reported temperature range between 23-30°C in Ayyanakere tank of Chickmanglore, Karnataka, India. Roy and Nandi (2008) reported the temperature range 19-35.5°C in some wetlands of West Bengal.

pH is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. In natural waters, pH also change diurnally and seasonally due to variation in photosynthetic activity which increases the pH due to consumption of CO₂ in the process. The microbial integrity of water also depends upon its pH value (Bouwer, 1978). Present study shows that pH of all four sites was ranged between 7.0-8.5. Tak *et al.* (2003) found similar observation from different sites of Asan wetland. It was recorded within the maximum permissible value (WHO, 1984). Yadava and Varshney (1982) reported pH of water varies from 6.65-7.75 in the wetlands of Manipur, N.E. India.

The minimum and maximum value of free carbon dioxide was reported as 1.2-2.5 mg/l during the present study. Similar findings were reported by Billore and Vyas (1982) in Pichhola Lake of Udaipur, Rajasthan. Sharma *et al.* (2008), Tak *et al.* (2003) reported similar observations regarding FCO₂ values in river Bhagirathi and Asan wetland (Dehradun) Uttarakhand respectively. Pathani and Upadhyay (2006) also reported similar FCO₂ values.

Dissolved oxygen is one of the most important parameter in water quality assessment and reflects the physical and biological process prevailing in the water. Its deficiency directly affects the ecosystem of a river due to accumulation and biomagnification. Maintenance and distribution of biota in aquatic ecosystems depends upon the concentration of DO to a great extent. High dissolved oxygen content is an indication of a healthy system (Bilgrami and Dutta Munshi, 1985). This study shows the minimum and maximum values of 8.0-9.8 mg/l from different sites of Asan wetland. While Tak *et al.* (2003) reported the DO was ranged in between 8.2-12.0 mg/l with its minimum values in the months of winter and maximum in post-monsoon. Pathani and Upadhyay (2006) reported similar observation as maximum values of DO 9.8 at Chakhutia of Kumaon during the study of Zooplankton, Zoobenthos and

fish fauna of river Ramganga of Uttarakhand, India. Kiran *et al.* (2007) reported DO ranged between 4.4-8.46 mg/l in Ayyanakere tank of Chitmaglore, Karnataka, India. Bhuiyan and Gupta (2007) observed the DO was ranged in between 5.85-11.28 mg/l in few ponds of Barak valley of Assam, India.

Chloride occurs naturally in all types of waters. Man and other animals excrete very high quantities of chloride together with nitrogenous compounds. Most of the water gets chloride in it when it flows through the area where salt is deposited. In the present study the chloride concentration is in between the range of 13.5-43.1 mg/l. Minimum chloride was recorded during post monsoon and maximum in winter season. Gupta *et. al.* (2008) reported similar observations from Mothronwala swamp of Dehradun (Uttarakhand).

BOD is the amount of oxidizable organic matter present in the solution and the BOD value can be used as a measure of waste strength. The BOD test is useful in evaluating the self purification capacities of streams which serves as a measure to assess the quantity of waste which can be safely assimilated by the aquatic body (Trivedi and Goel, 1984).. In the present study it was observed that the BOD values of water samples altered season to season and site to site. During the whole study period it was ranged as its minimum and maximum values of 2.2-4.6. The maximum values of BOD was higher than standard limit recommended by WHO (1984). The fluctuations in selected physico-chemical characteristics may be attributed to growth, death and decay of phytoplankton which could be as a result of human activities particularly of the tourist.

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APPLICATION FORM

I.....
hereby apply to be admitted as a Patron / Life / Annual / Affiliated / Institutional /
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My interests are

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MEMBERSHIP

All Members get Cheetal (Quarterly) Journal FREE

- | | |
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| 2. Life : | Rs.4000.00 |
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(April to March) |
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| (Others similar bodies) | |
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| (Messes, Units, Schools, Colleges, | |
| Govt. Deptts., Corporations, | |
| Societies, NGOs etc.) | |
| 7. Institutional Life | Rs.5000.00 |

Rs.500.00 per year

All Communications may please be addressed to the Hony. Secretary.

Signature

Signature

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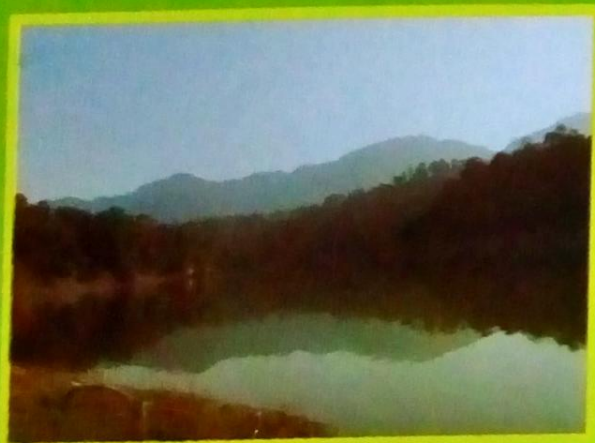
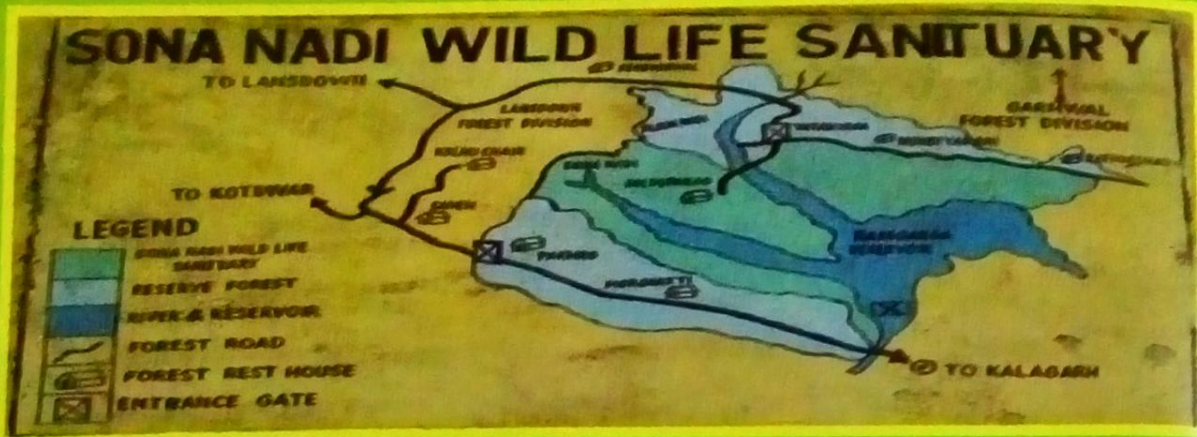
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